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of the
TEXTILE INSTITUTE

VOL. XIII.—1922.

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THE JOURNAL OF THE

TEXTILE INSTITUTE

Vol. XIII. JANUARY, 1922. No. 1.

PROCEEDINGS

This issue of the Journal of the Institute marks the onset of an important development in the production of the publication. The change in size has been effected in order that it shall be in conformity with the size officially associated with publications of Research Associations connected with the textile industries, thereby facilitating co-operation in the matter of publication of scientific communications. In this connection, co-operation is already in process of establishment, and, with a view to development in this direction, a special scientific section of the Journal has been created under the heading of "Transactions." Of late, this Institute has experienced a growing tendency towards the utilisation of its journal for the publication of scientific contributions both from investigators attached to research associations and to research departments of individual firms. It is intended to encourage this movement, and thereby foster publication and the spirit of co-operation. It is hoped that the "Transactions" feature of our Journal will become equal in importance to similar features of journals connected with other industries, and the magnitude of the textile industries is certainly sufficient to make this object attainable. Contributions will be welcomed and carefully considered with a view to publication.

This Journal now comprises three distinct Sections—Proceedings, Transactions, and Abstracts. The pages of the respective sections are to be numbered separately, whilst, at the year end, separate indexes will be provided. The "Proceedings" will embrace the papers and lectures submitted before Institute meetings, Notes and Notices, General Items and Reports, and Reviews of books. Each section will be capable of separate binding (with indexes of authors and subjects) on the completion of each year of issue. The Abstracts Section, as a result of co-operation and assistance on the part of the Research Associations for the Woollen and Worsted, the Cotton, and the Linen industries, respectively, has been considerably extended during the past two years, and effort will be continued in the direction of completeness of compilation. In this connection, the Abstracts Editor would be glad to hear of the possible services of abstractors familiar with the reading and translation of foreign journals.

As the scientific sections attain greater importance the Journal will appeal to a wider circle of readers, and, from the point of view of advertising, it offers a particular field for appeal. With the reduction in size of page, corresponding adjustment of charges for advertisement space has been effected and, notwithstanding the generally unfavourable conditions of trade, advertisers have readily availed themselves of space available. Advertisement rates and particulars as to special positions may be obtained on application to the Managing-Editor, Journal of the Textile Institute, St. Mary's Parsonage, Manchester.

YORKSHIRE SECTION.

Meeting at Bradford, 17th November, 1921, Mr. John F. White in the Chair.

INDUSTRIAL AND COMMERCIAL APPLICATIONS OF PSYCHOLOGY AND PHYSIOLOGY.

By Charles S. Myers, C.B.E., M.D., Sc.D.

As Director of the National Institute of Industrial Psychology, Dr. Myers said he felt he could best deal with this subject by enumerating the activities of the Institute named, which was incorporated so recently as February last.

The difference between the Industrial Fatigue Research Board and the Institute in question (he continued) is that the former is a Government Committee and is concerned with the problems of each industry as a whole, whereas there are, in addition, a vast number of problems connected with individual firms and people which are dealt with by the new Institute. The first aim of the Institute is the study of the requirements for different industrial and commercial occupations, and the satisfaction of these requirements. Knowing the requirements, to satisfy them opens up the whole problem of vocational guidance and vocational selection, which is becoming more and more important. There are institutes in connection with vocational guidance at Geneva, Paris, Berlin, Brussels, Barcelona, and various places in the United States of America. This guidance has relation to boys and girls of school-leaving age—as to whether they are fit to engage in the employment they propose to take up, or as to what occupation they should take up. All this kind of work is, relatively, in its infancy, but it is developing with experience, and, like surgery, without practice it cannot develop. Vocational selection enters in the selection of the best fitted individual from among a number available for a particular post, or in conditions where persons are engaged in work for which they are unsuited or where people may be hiding their lights under a bushel. In connection with vocational guidance and selection there are an enormous variety of tests now being standardised. In Barcelona, I saw children being examined as to health, height, strength, etc., that aspect of physique being gone into in special detail in connection with the particular vocations they might adopt. Then, the examination of character was considered of great importance. In this connection, a good deal can be done in interview by those who are expert in the process of interviewing. Lastly, there are psychological capacities to be sought for—specific abilities concerned with the work contemplated, for each of which appropriate tests are being devised. For each occupation special abilities are required. For salesmanship, for instance, tests are available for some of the special qualities desired. The same thing applies to telephone operators, compositors, motor-car drivers, tram drivers, etc. There are two broad methods of applying tests—either by using tests of actual employment which are applied, say, to a typist, or by analysing the occupation into its elementary psychological factors and applying tests which will test the elements. Tests for memory, speed of observation, dexterity, appreciation of form weight or surface can be thus applied. It has been found that both forms of test have correlated very highly with the order of rank in which individuals have been actually performing their work.

After giving several instances of differences observed in the skill of workers under varied circumstances, the lecturer proceeded:—A great deal of money is spent on training men who afterwards proceed to another job. For the most part, firms do not realise this, and no adequate records are kept of the cost in wages due to labour turnover. One firm discovered, however, that no less than £50 per head was lost in one year in labour turnover.

Again, much investigation is possible with regard to the best methods of applying human energy and the elimination of needless movements. This might be done, as in the past, by the efficiency engineer, or, far better, by the trained physiologist and psychologist, who does not make the mistake of regarding the worker as a mere machine. It is, for example, an error to assume that there is only one best way of doing a thing. One man's best way is not necessarily another man's best way. There are usually several good styles and, of course, many others extremely bad. Neither is it always a good thing to time a complex movement and divide it up with the hope of securing a better complex movement by combination of the best parts selected from among a number of workers.

On the side of distribution of work, the rest pause has been applied with good effect. Different kinds of work require different kinds of pauses. In a boot-making factory three girls instead of two were put on to a double press. Each worked forty minutes and rested twenty minutes, so that two were always working. The result obtained by the Fatigue Board investigator was an enormously increased output—over 44 per cent.

In the matter of length of working shift, no attempt should be made to apply data derived from one industry to another. On altering the length of working hours the effect is not reached at once. Introduction of new conditions might need months to reach a maximum improvement, though frequently it only requires a week or two for workers to re-adapt themselves. The interesting thing is that though workers slowly adapt themselves to the new conditions of shorter hours by increasing output, yet if overtime is added they very speedily adapt themselves by reduction of output.

Conditions tending to maximum contentment of the worker need to be carefully considered—the effect of labour representation, of effort to dispel monotony in occupation—while on the physical side there is the question of conditions producing maximum health. We have now an instrument, devised by Dr. Leonard Hill, to determine whether ventilation is sufficient or not. Temperature and lighting are also important considerations.

All these factors are now being scientifically measured by the psychologist and physiologist. Indeed, one of the most important aspects of the work of the Institute of Industrial Psychology will be that of research in connection with these problems. It has a strong Scientific Committee, consisting of thirty members—university professors and lecturers interested in psychology and physiology as applied to the human side of industry. It is starting as a central concern, but it hopes to develop local interest and to have various branches. The difficulty is to get men who have had training for this work, but, fortunately, the Fatigue Board has generously lent the Institute several of their ablest investigators. The Institute welcomes individual applications for the investigation of special problems.

There is a feeling that Labour is against this work, but the more the Labour people get to know about it the more are they inclined to take active interest in it. The Carnegie Trust, founded for promoting the welfare of the masses, has given the Institute a very substantial donation. The work is undoubtedly going to be of enormous importance. In the past we have been making the men fit the machine rather than making the machine suitable for the man who is to use it. In future, we have to select people for the work for which they are best suited, to discover how they can best be interested in their work, to arrange hours and conditions which suit them best, and, by that means, to get contentment and health in the worker and increase in the quality and quantity of their output.

Answering questions, the Lecturer said he did not think the selection of foremen could ever be decided merely by a few simple tests of a psycho-physiological kind. Character was an important consideration.

Asked if tests could be applied for salesmanship and how it was that an apparently unpromising individual often proved a born salesman, the lecturer said that there must be some psychological reason for this, and that a good deal of investigation had been carried out at the Carnegie Institute, Pittsburg, and elsewhere on the subject.

Mr. George Garnett (Bradford), moving a vote of thanks to the Lecturer, said that through the medium of the Works Committee opportunity is provided for bringing before workpeople the benefits of adoption of new methods. A great-deal of educational work could be carried on through supervisors and heads of welfare departments. The highest efficiency ought to be the aim of all in industry.

Mr. R. J. H. Beanland (Clayton West) seconded, and said that in the past, so far as selection was concerned, there had probably been too much reliance on hereditary instinct. There was great scope for investigation in regard to the sequence of operations on particular machinery.

The vote was heartily accorded.

DESIGN AND STRUCTURE OF FABRICS.

INSTITUTE'S CROMPTON SCHEME PRIZES PRESENTED AT BRADFORD TECHNICAL COLLEGE.

The prize awards made under the Crompton Prize Fund Scheme of the Institute, and secured by students at the Bradford Technical College in the 1920-21 Competition, were presented at an assembly at the Bradford Technical College on Wednesday, 7th December. The prize winning albums were on view, and considerable interest was taken in the specimens of work submitted by the competitors.

Mr. John F. White, as Chairman of the Yorkshire Section Committee, presided, and he was supported by Mr. John Crompton, Col. F. R. McConnel (President), the Deputy Lord Mayor of Bradford (Councillor Siddle), Alderman Guy, Mr. J. Sugden Smith, Mr. J. H. Halliday, Mr. H. Richardson (Principal of the College), Prof. E. Midgley, and Mr. E. T. Holdsworth (Hon. Secretary to the Yorkshire Section Committee).

The CHAIRMAN said he had always desired that a much closer link should be formed between the technical colleges and the Institute. He wanted the link to be forged much firmer than it had been in the past. When he suggested that the prizes secured by Bradford competitors should be presented in Bradford, he had in mind a thought that Mr. Crompton's example might lead some of their friends in the woollen and worsted industries to follow the example and institute a similar scheme in respect of woollen and worsted fabrics. He had pleasure in asking Mr. Crompton to present the prizes.

Mr. JOHN CROMPTON said he would like to compliment the people in Bradford, and Prof. Midgley in particular, on their success in having gained three prizes out of eight offered in connection with the scheme. He was delighted twelve months ago when Prof. Midgley expressed himself with regard to the scheme, and said that although it was primarily intended for cotton he felt they, in Bradford, could participate in it with great profit.

Continuing, Mr. CROMPTON said he would like to see Yorkshire have its own scheme, under which students could compete in those fabrics common to the district. He could assure any person interested, and with money to spare for a similar object, that it would be well worth while.

Mr. Crompton then distributed the prizes, and complimented the successful competitors who had secured prizes, as follows:—

Arthur Woodhead, 2nd Prize (£25 and Parchment Certificate); Edgar Robinson, £5 award; and Richard Eric Dudley, £5.

Mr. J. SUGDEN SMITH, in proposing a vote of thanks to Mr. Crompton, said the scheme had brought the trade into closer contact with the technical schools.

Mr. J. H. HALLIDAY seconded, and said the prizes had been given with the object of encouraging and developing a higher standard of design, colour, and structure of fabrics. We had strenuous times ahead, and to hold our own we should have to develop a standard of manufacture and design higher than that of any other country. We should require a very high standard of workmanship, with the British workman giving of his best, and if he would give of his best there was no better workman in the world. We should require a higher standard in the matter of design and colour, and the employer must get his organisation right.

Alderman GUY said that, as Chairman of the Bradford Education Authority and Chairman of the Bradford Technical College, it gave him great pleasure in welcoming the members of the Textile Institute. He hoped that meeting would prove the means of a closer union between the Institute and the College.

The PRESIDENT (Col. F. R. McConnel) thanked Ald. Guy for the welcome. The Crompton memorial scheme formed a link between the Institute, the manufacturers and technical institutions and students, and had banded them together in one common object of trying to improve things. A teacher must feel great pleasure and pride in his pupils taking the prizes. It was for the good of the country that the young men should have their minds focussed on that which was most satisfactory in art, colour, and design. It must eventually make its mark on the art and manufactures of the country, and so tend to keep our old country in the forefront of the manufacturing countries of the world.

At the conclusion of the proceedings, the members were conducted over the Textile Department of the College, and great interest was taken in the excellent equipment of the various sections.

NOTES AND NOTICES

EXHIBITION OF YARNS AND FABRICS.

As announced in our previous issue, it has been decided to hold an exhibition of special yarns and fabrics in the early part of this year. The Committee appointed to deal with the matter have recommended that the exhibition be organised with a view to opening on the day of the Annual General Meeting of the Institute, which is fixed to take place at the Institute on Tuesday, 25th April next. The recommendation has been approved by Council, and it is hoped that the event will be of first-rate importance and interest. The whole suggestion has been the outcome of the success of the exhibition organised by the Institute at the time of the holding of the World Cotton Congress at Manchester last year. It was felt that that exhibition was of a quite exceptional character and aroused unusual interest for an event of the kind. For the forthcoming fixture, however, it is proposed to widen the scope of the display. Whereas last year's exhibits were mainly connected with the cotton industry, it is hoped next time to include yarns and fabrics of novel and special character from various branches of the textile industry. The various Sections of the Institute have been invited to co-operate and to suggest names of probable exhibitors, whilst instructions have been given for the announcement to be made here that suggestions from individual members of the Institute will be gladly welcomed on the part of the Committee. The desire is that collections should be secured of as large a variety as possible of the newest products in yarns and fabrics. In the latter connection, the matter of finishing takes a prominent place, and firms concerned with finishing processes are asked to consider the proposition from the point of view of helping to bring about a display of really special interest.

THE INDUSTRIAL OUTLOOK.

It may be true that there are no definite, tangible evidences of trade revival as yet, but it is the fact that men are becoming more optimistic about such revival. It is true of the textile trade, and it is interesting that it should be so, for opinions have been voiced of late that the Lancashire cotton industry will never again be what it has been. But this represents what may be termed the old school of thought. We have developed now a higher criticism. Its exponents and their disciples take a larger, longer, fresher outlook. They see that the world has been keyed up to a higher pitch of living and that the productive industries must follow, or even be a little in advance. Certainly, the manufacturers who are just a little in advance will be those who flourish in the future. And that state is to be arrived at by improving technical efficiency and by turning to science and employing her as a handmaid. In many directions progress is being made towards the application of things scientific and technical to the industry, whilst, slowly but surely, steps are being taken to see that supplies of raw material are not to be obtainable from one source only. The present time of depression provides the opportunity for survey of future prospects, and the fullest use of all that scientists and technicians can give the trade should produce substantial results. The research movement in connection with the textile industries is beginning to assert itself more obviously and the ground is now thoroughly covered.

—R. C.

TRADE SQUABBLES.

The recent campaign against the finishing side of the cotton industry, in reference to their charges is to be deplored. There may be some ground for it; on the other hand the answer of the trade, which would seem to be borne out by the report issued by the Bleachers' Association, on their trading, may put the circumstances in their true light. That is not so much the point as is the fact that these squabbles do not lead to that harmony in an industry which is all the more desirable when the processes of manufacture are so highly specialised that each section is a distinct trade in itself. From the raw material to the marketable article, each process of manufacture is linked on to the succeeding process, and there ought to be liaison, not detachment, between the two sections. That liaison should be something more than friendly relations between firms; it should be a technical, a scientific link which will blend the processes one into the other. The first step is to establish those friendly relations, and it is, if not impossible, at least the more difficult when charges and counter-charges about excessive costs are being exchanged. At the recent World Cotton Conference a suggestion was made by one of the speakers that the various sections should come together and establish something in the nature of a joint committee or body that should discuss trade matters from this point of view of technical co-operation. Sooner or later something of this kind will be done; the new conditions of industry demand it. But there is a certain awkwardness in taking the first step when the atmosphere has been disturbed by all these charges. After all, every section is more or less dependent upon every other section; the prosperity of one means the prosperity of the other, and there can be no question of fighting for one's own hand. That is economically out of date now. To-day, we are tackling trade problems from a new and very much wider angle. —R. C.

WOOL AT MANCHESTER.

There is a good deal of inertia to be overcome before Manchester becomes a wool port. It is not a question alone of established custom in the West Riding, or the dead impassive weight of London, but also of the convenience of foreign buyers. When the matter cropped up some time ago, the view was expressed by a wool buyer that it was these representatives from foreign houses who would turn the scale, and he inclined to the belief that they would turn it in favour of London —that is the existing system in Coleman Street—because of the convenience of getting to London. But after all this presents itself as rather a small factor in the business. A good many old ideas have been cast overboard since the war, and men are more ready to try out new schemes, more ready to adopt new methods when they can be shown to be valuable and economical. And to-day it is the factor of economy that counts. Here, in a great measure, is where the Port of Manchester scores. It is within such easy road and rail distance of the West Riding that transport costs must sooner or later count, and they will count sooner rather than later, for it is being recognised that cheap transport is one of the keys to a revived industry. Rail freight charges will probably fall before long. More to the point is that road transport, which in many ways is more convenient, can also be made very much cheaper. There is a producer-gas device now on the market—it is running, and running successfully, attached to industrial motor vehicles—which makes gas whilst the vehicle runs and that gas fuel is obtained at a cost claimed to be equivalent to petrol at 3d. or 3½d. per gallon. What a saving that means in a week's running alone can easily be calculated; it is equivalent at least to a good profit. It means very much cheaper transport, and the more transport is cheapened the nearer we get to the day when Manchester becomes a wool port. —R. C.

LECTURES TO ENGINEERING FOREMEN.

In connection with the Department of Industrial Administration at the Manchester College of Technology, a course of lectures for engineering foremen and supervisors has been arranged. The lectures will take place each Tuesday evening, commencing on 24th January, and the syllabus indicates that great care has been taken in order to provide for a really interesting course of study. The first lecture will be by Mr. A. P. M. Fleming, who will deal with "Records and Statistics: Their Value and Use." Other subjects offered include "Labour Aspirations," "Works Committees," "Unemployment," and "The Selection of Workers," the last-named subject to be dealt with by Mr. Dempster Smith, Acting-Director. The fee for the course of ten lectures is 17s. 6d. The Department of Industrial Administration at the College now offers a two years' full-time course, both in industrial administration and in industrial and social welfare work. In the prospectus, it is pointed out that as a rule much study is given to technical qualification for management, and the science of administration calls for consideration, the contention being that "a fuller knowledge of economic problems and of their inter-allied and psychological re-actions will be a necessary equipment for the manager of the future." The two years' full-time course for industrial and social welfare work is intended to meet the requirements of persons desiring to qualify for employment as welfare supervisors, employment managers, social workers, secretaries, etc. Part-time courses are also provided for students already in employment.

GENERAL ITEMS AND REPORTS

TEACHING OF ART IN RELATION TO COMMERCE.

A report has been issued by the British Institute of Industrial Art on the Teaching of Art in Relation to Commerce (H.M.S.O., 1921, pp.16, 4d. net). Although the arrangements contained in the report are chiefly designed to meet the needs of intending artists, craftsmen, or teachers, it is stated that it is also vitally important to the advancement of both British art and of British industry and commerce that those who, though not themselves intending to become artists, or craftsmen, are destined to fill responsible positions in commerce and industry, where they will be concerned with organising the distribution or production of works of industrial art, should have more adequate opportunities of obtaining an art training suitable to their special requirements.

A request from the Vice-Chancellor of the University of London, that the Institute should advise on the subject and teaching to be included in the "Commercial Art" option for the new Degree in Commerce, led to the appointment of a special committee of Governors and Fellows of the Institute.

It is the considered opinion of the Committee that the art training of the buyer and seller is a matter of great national importance in view of the great influence which they are in a position to exercise in the direction of elevating or degrading the standard of public taste. With these things in view, recommendations have been made and outlined in a scheme which suggests that the principal branches of industrial art might be grouped under heads such as (1) Textiles, (2) Ceramics, (3) Printing, (4) Metal-work, and (5) Wood-work

The report contains details of the proposed scheme. —A. E. G. B.

PRACTICAL AND TECHNICAL DYEING DIFFICULTIES.

A discussion on this subject took place under the auspices of the Huddersfield Section of the Society of Dyers and Colourists at Huddersfield on Friday, December 9th, Dr. L. Gordon Paul presiding.

Mr. **Edmund Stapleton** said that one of the greatest problems facing the dyer was that of listed pieces. Twenty or thirty years ago the trouble was unknown, because it was not looked for. At that period, if the required shade were produced, the goods would pass, and the list or selvedge was not compared with the middle. A listed piece was one in which the list or selvedge was darker or lighter in shade—usually darker—than the middle of the cloth. The immediate cause was difficult to find. It was an old saying that "a good scourer makes a good dyer," and although the dyer was sometimes too hard on the scourer, part of the blame often rested on the scourer. Certain oils and sizes were used in making a worsted cloth, and were difficult to remove by scouring. It had also been suggested that the cause was sometimes a mechanical one. In some goods, such as venetians and satin-faced cloths, he had noticed slackness at the sides and the ends, which caused a perceptible difference in shade, especially in light shades. Milling made the shade darker. Some pieces rolled up at the side when wet, through bad weaving and tight warps, and the dye could not get through. The remedy was to " bag " the piece—*i.e.*, to sew the edges so that it formed one continuous tube. Listed and flecked pieces were sometimes caused in the dyehouse, and were generally due to (1) entering goods into liquor too hot; (2) reaching the boiling point too soon; (3) not boiling thoroughly either in chroming or dyeing. It was the harder twists which were usually subject to listing, and there was seldom any trouble with soft goods.

Mr. MORTON (Halifax) said they had come to the conclusion that most of the trouble was caused in the preparing of the pieces, and by exercising great care in the crabbing, blowing, milling, and scouring processes they had effected a great improvement.

Mr. R. F. WHALLEY said that he knew of a case in which the dyer was also the manufacturer, and he put the fault down to faults in manufacture. If the warps were not beamed and woven properly, the piece was slacker on the list than in the middle, and this caused more dye to be taken up. In the case in question, the manufacturer would not have any warps made outside, and he claimed to have removed the trouble of listed pieces.

Mr. J. HOLLINGWORTH said that in a listed piece the fault was so very regular from one end of the piece to the other that it was difficult to see how it could be caused in a dyeing machine, where the piece went through in rope form, twisted about in any shape. It seemed to him there were about half-a-dozen different causes, some of them due to manufacture, some of them to scouring and finishing. One of the greatest causes was the crabbing and blowing process, and if it were not done thoroughly the pieces would be either listed or cloudy.

Mr. G. F. COPLEY said that in cotton gaberdines, where very exact shades had to be obtained, he had found that the tension of the yarn had a good deal to do with the shade, and he believed the same applied to wool goods. If there was too much tension in worsted spinning, or the yarn were wrapped too tightly on the cop, it would show weft marks.

Mr. STAPLETON said that crabbing would not explain all cases, because although they crabbed the coarse goods and lighter weights they did not often crab a good botany cloth of 18oz. weight, and yet the same trouble occurred. —M.

WELFARE WORKERS' INSTITUTE.

The annual report 1920-21 of the Manchester Branch of the above-named Institute records a small decline in membership—53, against 67. It is gratifying to note (the report says) that firms who have once created welfare schemes regard them as an essential part of industry, and as one of the last of activities with which they would willingly dispense. Nevertheless, owing to trade conditions, schemes for progress and improvement have had to be delayed until a more opportune time. Mainly as a result of this Branch's advocacy of courses of training for welfare workers, a scheme of training has been formulated by the Manchester College of Technology and approved by the Institute's executive. The Branch continues to hold its meetings at the Textile Institute.

COTTON SPINNING DIVIDENDS IN 1921.

Mr. Frederick W. Tattersall, of Manchester, has prepared his usual tables of cotton spinning companies showing the dividends paid during the twelve months ending 30th November, 1921. All the firms dealt with confine their operations to spinning yarn, and no names are included of weaving concerns. Particulars have been obtained of the reports of 230 companies, and of these 23 have not been able to make a distribution to shareholders during the year. Thirty-six have paid a dividend at the rate of less than 2½ per cent. per annum; thirty-eight between 2½ per cent. and 5 per cent.; twenty-seven between 5 and 7½; twenty-four between 7½ and 10; twenty-two between 10 and 12½; eighteen between 12½ and 15; eight between 15 and 17½; ten between 17½ and 20; three between 20 and 22½; six between 22½ and 25; nine between 25 and 35; four between 35 and 40; one 47½, and one 50 per cent. per annum. These 230 companies have a total paid-up ordinary share capital of £25,330,393, and the average dividend per company is 9·97 per cent. per annum. A sum of £1,929,386 has been absorbed by the payment of the above dividends. The mills contain 21,511,799 spindles, consisting of 18,616,993 mule and 2,894,806 ring.

Owing to the fact that during the boom of 1919-1920 many mills were sold and refloated on an increased capital basis, it is not possible to give true comparisons of the trading for the previous twelve months in each case, but figures for this purpose have been secured for 150 of the 230 companies. These 150 companies have a total paid-up ordinary share capital of £15,935,893, and the average dividend per company for the year ending 30th November, 1921, works out at 12·10 per cent. per annum, against 40·21 per cent. per annum for the same concerns for the twelve months ended 30th November, 1920.

In order to ascertain the effect of the buying of mills and reflotation at enhanced capital values on the dividend-earning capacity of the companies, Mr. Tattersall has prepared separate tables of the trading results for what may be described as old mills (those which have not been sold), and the new firms which changed hands and had their capital increased. Of the 230 companies, 57 which have kept their original capital intact and have a total paid-up ordinary share capital of £2,951,596 have paid an average dividend per company for the year ended 30th November, 1921, of 20·52 per cent. per annum, whereas the average dividend per company for the remaining 173 reconstructed concerns, with a total paid-up ordinary share capital of £22,378,797, is only 6·50 per cent. per annum.

FUTURE DEVELOPMENT OF THE POWER LOOM.

Addressing the members of the Blackburn Textile Society on Friday, the 16th December, Mr. William Wilkinson, head of the Textile Department of the Blackburn Technical College, dealt with the future development of the power loom for ordinary fabrics and for special fabrics. He said that the human element was the greatest factor in the efficiency of any process, and it was when the efficiency of the machinery used was at the greatest that the work of the operative was at the least. Eighteen years ago the power loom weaver had to separate the warp threads behind the rods with a small comb, had to move the temples after weaving a breast of cloth, had to adjust the weights, change the wheels, and spend a lot of time regulating various processes to make a saleable cloth. Even with those disadvantages, and with inferior industrial organisation, the weaver produced twelve pieces, or about 360 yards, per week. By reducing the work of the operative and increasing the efficiency of the process, the weaver of to-day could produce twenty-eight pieces, or 840 yards, from yarn inferior in weaving quality, and with a reduced working week. The question was as to how production could be increased. The power loom in its present form was not capable of higher speed and, therefore, they must look for some other solution. Was it not possible to so improve the weaving process as to enable a weaver to work six looms with the same or less effort than was now required to work four looms? To render this possible, he advised greater skill in the selection of yarns, greater attention to the preparatory processes which played a great part in the efficiency of weaving, and standardisation of machinery. The false policy of cheapness should be dropped and the loom constructed on a sound mechanical basis. Improvements should be encouraged and endeavour made to eliminate strain and frictional abrasion of both warp and weft yarns. The young weavers should be trained under conditions which would give them a fair chance to compete favourably with the experienced weavers. Overlookers should be trained on sound lines, and men of superior ability encouraged to occupy important positions. A greater interest in the industry should be encouraged by welfare schemes. If those measures were taken, the Lancashire weaver would soon show a greater productive capacity and would be happy and comfortable. What was wanted was less work for the weaver and greater production—not brawn, but brains. It was necessary that Lancashire should excel on the special fabric which required accurate machines and skilled workers. In this connection there should be the hall mark of quality on every yard of cloth produced and a standard established that would characterise the Lancashire goods. Here was a wonderful field for development which they would be well advised to foster—the production of fabrics which were beyond their lower skilled competitors who were attempting to capture foreign markets on the low grade ordinary fabrics. The increased tendency was for fabrics with new and novel yarns. The spinner, working in conjunction with the weaver, could find an unlimited field in that direction.

REVIEWS

Dress, Blouse, and Costume Cloths: Design and Fabric Manufacture. By Robert S. Beaumont, M.Sc., and Walter Geoge Hill. (Sir Isaac Pitman and Sons, Ltd., London. Price, 42s. net; 579 pages, and eight coloured plates.)

In this book it has been sought, in reference to dress, blouse, and costume cloths, " to interpret (1) the commercial and industrial aspects of the trade; (2) the nature, structure, and the qualities of the yarns employed; (3) the weaving principles involved; (4) the design and colour schemes elaborated; and (5) the systems of fabric build and manufacture practised."

The work is divided into ten chapters, and contains over 700 illustrations.

Chapter I. treats on industrial and commercial aspects, and deals with schemes of dress fabric manufacture, the influence of fashion, style transitions, etc. Fig. 19 in this section is described as " Embroidered voile," although it has the appearance of either a swivel effect or a cut-off extra weft style. The chapter concludes with useful remarks on standardisation in the dress industry, the shipping trade, prestige of French fashions, phenomena affecting trade in the Near and Far Eastern countries, Board of Trade intelligence and foreign trading, and British industrial centres.

In the second chapter, which is entitled " The Yarn Unit," the characteristic features of cotton, linen, and metallic threads, and of various kinds of worsted, woollen, union, and fancy yarns, are described. Exception may be taken to the statement on p.56 in reference to worsted yarns, that " the combed slubbings, on the English practice, receive, at each operation in the drawing sequence, a quota of false twist and a percentage of oil." Silk (thrown, spun, and artificial) is treated separately in Chapter III. Technical terms applied to silk textures, and sources of silk and silk waste supplies, are detailed, and an interesting description of the various processes employed in producing spun silk yarns is given, which, however, would have been improved by the introduction of a few additional line drawings. The section on Artificial Silk has been contributed by the late Mr. Leonard Wilson, F.I.C., of Messrs. Courtaulds, and is a clear and concise exposition of the methods employed in producing different classes of artificial silk. Their qualities, relative properties, and values are described, as well as the treatment of the material as regards dyeing, sizing, storing, winding, spooling, twisting, warping, and weaving; and the new product " fibro," defects in fabrics, and the trend of development are discussed. " The Yarn Unit Applied " is the heading of Chapter IV., in which different kinds of yarns and the fabrics made from them are compared.

In Chapter V., which is headed " Weave Elements and Cloth Construction," a number of simple and fancy weaves are given in a somewhat promiscuous order of arrangement, pure sateen weaves, for example, being preceded by weaves based upon sateens. Chapter VI. is headed " Drafted Patterns: Stripes," and Chapter VII. " Geometric Design Bases—Weave Compounds." Spotted and Mosaic Patterns are dealt with in Chapter VIII., and a number of illustrations of figure printed fabrics are given as suggestions of woven designs which would be very difficult to reproduce on account of the fineness of the details. Figuring with warp and weft, with extra warp and weft, and with double weaves is included.

" Practice in Figure Designing " is the heading of Chapter IX., and includes a brief reference to Historic Ornament, and Chinese, Japanese, and Indian styles. The transference of a sketch design to point paper is illustrated, and a number of examples of figured fabrics, with corresponding sectional plans, are given, but cloths composed of one warp and weft are mixed indiscriminately with different kinds of compound textures. In the last chapter pile, lappet, and gauze structures are dealt with, the pile section including cotton velveteens, weft plushes and curls, and plain and figured warp pile textures, with some excellent illustrations. In the case of two illustrations of velveteen plans, it is stated that " marks = weft " when warp is meant. The section on lappet weaving contains many errors, as, for instance, in the description of the loom mounting about the bottom of p.535, and in the statement on p.537 " that the floating ends, between one row of effects and another, are on the reverse side of the cloth." Fig. 330 is described as " lappet and swivel-woven texture," and Fig. 332 as " lappet and gauze striping," although both are simply lappet effects; also stripe C in Fig. 332 will not require a front and back frame, as stated. Further, it is very improbable that an effect such as that illustrated in Fig. 328 would be woven with the frames moving in opposite directions to each other at the same time.

Gauze weaving is somewhat briefly dealt with, but the illustrations have been well selected.

Many of the illustrations of weaves, designs, and fabrics are quite as suitable for suitings, mantle cloths, or decorative fabrics as the textures mentioned in the title of the book. Chief consideration is given to the heavier classes of cloths, and sufficient prominence is not given to the light and dainty types of dress and blouse fabrics which have been so prominent a feature of the trade during recent years. In certain parts of the book the text is well and concisely written, but in many places there is a lack of simplicity of expression and a redundancy of words which confuse the meaning and make the book difficult to read. As an example, the following, which refers to piece-dyeing of grey cloths composed of different classes of materials, is extracted from p.34:—" While the employment of yarns, made of special sorts of fibre, either plain or pattern-decorated textiles are also obtainable with each yarn, in the finished texture (woven in the grey), distinct in tone, tint, or hue, that is, as identical in colour, freshness, and property as if the yarns applied were hank, top, slubbing, or material dyed and prior to weaving."

The get-up of the book is excellent in every way, but it is doubtful if, at the price, it will appeal to the ordinary textile student, although manufacturers will find something of interest within its pages. —W. WATSON.

PATENTS AND CHEMICAL RESEARCH. By Harold E. Potts, M.Sc. The University Press, Liverpool. Price 8/6.

Although written in relation to the chemical industry, this book deserves study by all concerned with the protection of their manufactures by patents. It would be difficult to find a better statement of the essentials of patent law and practice generally. Different aspects of important points being separately considered are brought out more forcibly and clearly than they could be in closely knit sequences of proposition and qualification, especially as regards the fundamentals of proper protection by patents—to determine what is the real invention in any case, and its range of application, to give ample and accurate indication of its nature, to make full disclosure of how best to carry it out, and to prepare valid claims which shall be wide enough to prevent evasion.

Three pleas are put forward with cogent argument:—that endeavour to work a manufacture as a secret is generally futile, that consequently proper endeavour should be made fully to take advantage of the protection afforded by the patent law, and that for full advantage to be taken a manufacturer should have a policy of wide outlook and regard patents as a protection for his own manufacture against infringement and competition, as a weapon against competition, and as a means for negotiating concessions in the broadest sense nationally and internationally. In so far as the compulsory working clauses of the patent laws of some important countries make it practically impossible to hold a patent for long without establishing internal manufacture, it may be urged that the possibility of exchanging concessions internationally merits more consideration than it commonly receives.

In regard to secret processes, there is little chance—as the author points out—of the result of one research being undiscoverable by other research, and even in the rare case of a secret process founded on a lucky and unlikely accident there are many dangers probably amounting to certainty of eventual disclosure. The author suggests an injunction might be granted against an employé intending to disclose a secret, but if the injunction should be disobeyed or disclosure should have been made already it seems impossible to restore the secrecy.

On page 16, reference to those inclined to under-value patent protection as "opponents of the patent system" is temporarily misleading.

The author is to be commended for forcibly indicating the minute care which ought to be taken to ensure that everything relevant, though it may arise from accident, convenience, or even carelessness, should be considered in preparing the specification of an invention, lest any essential should escape attention, as, for example, the unsuspected influence of containing vessels in making a process work. The author is to be commended, too, for emphasising that the much used saying "a principle can not be patented" ought for practical purposes now to be forgotten, the word "principle" having become ambiguous in this connexion.

The author very strongly urges that patents both as means of protection and as obstacles to be avoided should be taken into consideration even before research begins and that thenceforward there should be collaboration with the patent agent. While this is emphatically necessary in chemical cases, such collaboration is to be recommended generally.

This is a book to read, and to read through. —H. C.

BLEACHING. By S. H. Higgins, M.Sc. The University Press, Manchester, and Longmans, Green & Co., London. Price 10/6.

The author has given a very complete résumé of the most important researches, bearing on the bleaching of celluloses, which have been published during the period 1908-1920. He, like others engaged upon research in connection with cellulose bleaching, no doubt experienced the difficulty of obtaining all the publications relating to the subject, particularly those which appeared in foreign journals during the period of the war.

The difficulties which present themselves in "textile chemistry" are alluded to in the introduction, and the author quite rightly points out that definite conclusions should not be drawn from one or even two experiments, and that reliable results are only to be expected if experiments are conducted under industrial conditions.

Abstracts from the publications by various authors are given under "Constituents of Vegetable Fibres" and the "Eliminations of the Non-cellulose Constituents," such as wax and proteins.

The application of hypochlorites in the bleaching of vegetable fibres is very fully dealt with in Chapters VII and VIII.

A very complete résumé is given of the publication relating to water in celluloses, the action of strong alkalies, of acids and of oxidising agents, and this is followed by abstracts dealing with work on the finished product and on the effect of fermentation.

The last two chapters are devoted to different bleaching processes and to faults in bleaching.

The research student and the chemist in the works will find the book a most valuable help in their work. The experienced investigator will have no difficulty in determining the value of the different researches discussed in the book, but to the research student it should be pointed out that, in many cases, a large amount of systematic investigation will still have to be carried out before it is safe to arrive at final conclusions. The subject of cellulose in all its different branches is becoming so unwieldy that books like "Bleaching," which deal with one branch only, will be welcomed by many. It may be suggested that the value of the book would have been enhanced and the cost of production but little increased, if some of the most important publications had been more fully abstracted. The book is well printed on a good substantial paper. —J. H.

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PROCEEDINGS

YORKSHIRE SECTION.

Meeting at Bradford, 15th December, 1921. Mr. John F. White in the Chair.

THE LEGAL REQUIREMENTS IN THE EQUIPMENT OF WORSTED COMBING AND SPINNING MILLS.

By C. F. Wright, O.B.E., H.M. Superintendent of Factories.

My object in preparing this paper is to place before you the law's requirements so far as they affect the erection and equipment of wool combing and worsted spinning mills and I shall at the same time offer a few suggestions, so far as my experience goes, as to the most suitable means of carrying out these requirements in practice.

These requirements are practically contained in two series of Acts—(1) the Public Health Acts 1875, 1890, 1891, and (2) The Factory and Workshop Acts 1901—The Police, Factory &c. Act, 1916, and the Employment of Women, Young Persons and Children Act, 1920.

As a matter of historical interest, it is worth recording at this point that the first Act for regulating conditions in regard to the health of persons employed in cotton and wool factories dates from 1802. The first enactments dealing with the public health generally are, as you are fully aware, of a much later date. Assuming that the site of the factory has been decided upon and that sufficient land has been purchased at a reasonable figure, but not before the very fullest consideration has been given to (1) the available supply of labour, (2) the facilities, (3) means of road transport and (4) local water, gas and electricity service, I would ask you to bear in mind that the essence of design is putting the material in the right place; and, further, I would remind you of an expression I have heard in Lancashire in regard to the planning of a textile mill, which is as follows:—" First put your machinery down, then put four walls around it, and light it from the top." With this expression I am sure you will agree, but it is not always possible in practice, especially so at the present moment when the cost of building is so great.

After this digression I will now proceed to discuss the law's requirements in detail in regard to the factories under discussion.

Public Health Acts.—Under these Acts, the Local Authority, either a County Borough, Borough, or District Council is empowered to make certain bye-laws regulating the erection of all buildings within its area. The general provisions of these bye-laws are to the effect that plans of all buildings, together with details of drainage, sanitary conveniences, and, in the case of factories, means of escape in case of fire, shall be submitted to the local authority for approval before building operations are commenced. The usual procedure on the part of those intending to erect a building is to get into close touch with the authority's surveyor, who will provide all the necessary information as regards carrying out the bye-laws requirements.

THE FACTORY ACTS.—The Factory Acts apply to a certain extent during the building of a factory. Under Section 105, the Secretary of State has power to make regulations for the safety of persons employed, and regulations for this purpose are now in draft. Accidents must be reported to the Inspector for the District, and Inspectors have the right of inspection, and they may apply for an Order from the Justices to prohibit the use of any dangerous machine used in the process, &c.

A useful Memorandum has been issued by the Home Office for the guidance of builders.

HEALTH : FACTORY AND WORKSHOP ACTS : CLEANLINESS.—The Act of 1901, section 1, requires—(*a*) every factory to be kept in a cleanly state, (*b*) that it must be kept free from effluvia arising from any drain, water closet, privy, urinal, or other nuisance, (*c*) it must not be so overcrowded while work is carried on therein as to be dangerous or injurious to the health of the persons employed therein, (*d*) it must be ventilated in such a manner as to render harmless so far as it is practicable all the gases, vapours, dust or other impurities generated in the course of the manufacturing process or handicraft carried on therein that may be injurious to the health. As regards (*a*) it is further laid down in the same section that for the purpose of securing the observance of this requirement all the inside walls of the rooms of a factory, and all the ceilings or tops of those rooms, whether plastered or not, and all the passages and staircases of a factory, if they had not been painted with oil or varnish once at least within the previous seven years, shall be limewashed once at least within every fourteen months; all painted or varnished parts must be washed down with hot water and soap once at least every fourteen months.

The Secretary of State may under the same section by Special Order grant to any class of factories or parts thereof a special exception that the above requirements as to limewashing shall not apply, and this has been done by Order dated 2nd November, 1903.

This Order exempts all inside walls from periodical limewashing if, among other things, such walls are constructed of glazed brick, and it has been taken advantage of in the case of some wool factories, though not to the extent which one would expect. The advantage of being able to dispense with the periodical limewashing of the inside walls of a wool-combing or worsted-spinning mill is quite obvious to anyone having business therein and consequently the use of glazed bricks in the construction of the inside walls of the workrooms, passages, staircases and sanitary conveniences, as far as possible, should be very carefully considered.

The requirements of sub-section 1 (b) are for the purpose of securing good drainage work and the provision of a well ventilated space between the workshop and the sanitary conveniences. This last provision is often found to have been omitted in the case of mills recently erected. It is difficult to explain why such a provision is overlooked by architects, and even local authorities have been known to approve building plans without such provision being included. I might add here that new plans of factories are not required to be submitted to H.M. Inspectors for approval before building operations are commenced, but as a matter of fact the majority of firms take the precaution to do so.

Sub-section 1 (c), prohibiting overcrowding, has little bearing on either a combing factory or a spinning mill. Such a question can hardly arise in modern mill practice, for under Section 3 of this Act an allowance of 250 cubic feet of space only for each person employed is necessary. There is no regulation in the Act as to the area of floor space for each person.

Sub-section 1 (d), referring to ventilation and the removal of gases, vapour, dust, &c., has an important bearing on the equipment of a wool combing factory. Too much attention cannot be given to the design of the plant for the removal of dust either generally from floors, walls, beams, ridges and similar places or locally from carding machinery, &c. It is suggested that the adoption of the vacuum principle would prove successful. It has shown its efficiency in many textile mills and has already been applied to carding engines working on scheduled wools. Whatever system is adopted it should particularly aim at the removal of the dust at the point at which it arises.

Section 6 requires that adequate measures must be taken for securing and maintaining a reasonable temperature in each room in which any person is employed, &c. This measure means that rooms must neither be too cold nor too hot. The usual and successful method employed in warming a worsted spinning mill is by steam conveyed through a sufficiency of wrought iron pipes carried around the various rooms. In wool-combing, the problem which arises is that of preventing a combing room from becoming too hot, and to guard against such an occurrence care must be devoted (1) to the design of the room and (2) the mechanical appliances for removing the heat generated in the process. Combing rooms should be on the shed principle—lofty, lighted from the north, and constructed with a saw-tooth roof. All heat-producing plant should, as far as possible, be separately enclosed and connected directly to an exhaust leading to the open air.

The mechanical appliances for the removal of heat from the room generally require to have the most careful attention. As a rule, they are planned on the exhaust principle, but a combination of exhaust and plenum systems has given good results in several instances. The provision of fresh air inlets should be so arranged as to ensure an ample supply and, further, steps must be taken to prevent any such supply being drawn from other parts of the factory, *e.g.*, engine room, over steam boilers, wool scouring department, &c. The roof of the combing shed should be kept well limewashed on the outside from May to the end of September.

Section 7 is an enlargement of Section 1 as regards ventilation, and it also permits the Secretary of State under Special Order to prescribe a standard of sufficient ventilation[1]. This has been done for worsted spinning rooms where artificial humidity is produced. The Order requires that 600 cubic feet of fresh air shall be supplied per hour for each person employed.

Section 8 provides for the proper drainage of workroom floors where any process is carried on which renders the floor liable to be wet. This section will apply more or less to the wool scouring department. In constructing the floor of a wool scouring room, care should be exercised in deciding on the area of the paving blocks or slabs; it is much more satisfactory to employ one of small area than one of large. The disturbance of the floor is less when removals are necessary and a much better sitting of the blocks will be obtained by the use of the units of small area in the first instance.

Section 9 requires that a factory must be provided with sufficient and suitable accommodation in the way of sanitary conveniences, regard being had to the number of persons employed, and also, where persons of both sexes are employed, with proper and separate accommodation. The Secretary of State shall by Special Order determine what is sufficient and suitable accommodation within the meaning of this section. The local authority under the Public Health Acts shares the responsibility with the Inspector of Factories of carrying out this provision under the Act 1890, Section 22, if adopted by that authority. The standard of the local authority in nearly all cases is that contained in the Order mentioned.

We will now touch on the sections in reference to safety :—

Section 10 contains requirements concerning the safeguarding of hoists, engines, motors, water wheels, and other prime movers, mill-gearing or transmission machinery and dangerous parts of the machinery. Such plant must be securely fenced or be in such a position or of such construction as to be equally safe to every person employed or working in the factory.

Various pamphlets on safeguarding have been and are still being issued from time to time by the Factory Department. These pamphlets will be found of great service when equipping a mill. They are obtainable from H.M. Stationery Office (" Hoists, Transmission Machinery, &c.") for a small sum.

A Report on an Agreement as to safeguarding of wool machinery made between employers, operatives, and inspectors concerned has also been published[2] and this will prove of great usefulness, especially as regards the fencing of the various machines in use.

Section 11 provides for the safe working of steam boilers and their periodical examination by a competent person. A Report on this examination is required to be kept in the Factory Register.

This examination must be thorough, every 14 months, and careful thought should be given as to accessibility and location. Boilers are still found in basements and underground premises, and the difficulties in carrying out examination and repairs under such circumstances will be very apparent.

Section 12 lays down regulations for self-acting machines, in our case mules. The traversing carriage in a factory erected after 1896 must not be allowed to run out within a distance of 18 inches from any fixed structure not being part of the machine if the space over which it runs out is a space over which any person is liable to pass whether in the course of his employment or otherwise; provided that nothing in this sub-section shall prevent any portion of the traversing carriage of any self-acting cotton or woollen spinning machine being allowed to run out within a distance of 12 inches from any part of the headstock of another self-acting spinning or woollen spinning machine. This means that care must be exercised in placing the pillars in a spinning room in suitable position in relation to the mules.

In the Agreement already mentioned, a provision is inserted in regard to the safe spacing of carding engines; the distance between any two carding engines need not be less than 24 inches and the distance between any part of a carding engine and any fixed structure—a wall or a pillar for example—must not be less than 18 inches.

Section 14 provides for suitable means for escape in case of fire. In factories constructed since 1st January, 1892, and in which more than 40 persons are employed, the occupier must hold a certificate from the local authority that the factory is provided with such means of escape as can be reasonably required. It is the duty of the local authority to examine every such factory and, if satisfied, grant such a certificate. The certificate must specify in detail the means of escape so provided.

In factories built previous to the date named and in which more than 40 persons are employed, the local authority has power to examine such factories from time to time and require the owner to make such provision for providing the necessary measures for means of escape as are necessary. The inspector and local authority have a dual control here, it will be noticed, so far as means of escape in case of fire are concerned. This does not altogether mean the provision of means of escape by outside iron ladders; a room is often provided with better means of escape by internal enclosed staircases. Where it is necessary to erect outside iron ladders care must be exercised in the design of the opening on to them; it is very often the case that a window or door opening on to an outside means of escape blocks up the fair-way from other floors in the factory.

Section 16 enacts that in every factory the construction of which was commenced since January 1st, 1896, the doors of each room in which more than 10 persons are employed shall open outwards or be sliding doors.

Section 79 gives power to the Secretary of State to make regulations for the safety of persons employed in dangerous trades. He has made regulations in several branches connected with the wool industry. As you are fully aware, there are the Regulations for sorting, willeying, washing, combing and carding of certain scheduled wools[3] and the use of East Indian wool[4]. In addition, there are Regulations for the use of locomotives and waggons on lines or sidings used in connection with premises under the Factory Acts[5]; the generation, transformation, distribution and use of electricity in factories[6]; the process of spinning by self-acting mules[7] and it is quite possible that Regulations for loading and unloading any ship at any dock, wharf, or quay, &c.[8], might apply in certain cases.

These several regulations contain many points affecting structural requirements; they must be carefully thought out when designing a new mill or one will be in a sorry plight later, say at the first visit of the Inspector, if neglected.

We have now practically come to the end of the requirements of the principal Act for as regards to the lay-out of wool mill, but there are one or two other requirements which I must call your attention to in the Act of 1916. This Act was passed during the War as you will see by the date. It was designed to meet the necessity for the Welfare of the Workers in factories generally, Section 7 reads as follows:—"Where it appears to the Secretary of State that the conditions and circumstances of employment or the nature of the processes carried on in any Factory are such as to require special provision to be made at the Factory for securing the Welfare of the workers or any class of workers employed therein in relation to the matters to which this section applies; he may by Order require the occupier to make such reasonable provision therefore as may be specified in the Order . . . ."

The following are the matters to which this section applies.—

Arrangements for preparing or heating, and taking meals.
The supply of Drinking Water.
The supply of protective clothing.
Ambulance and first-aid arrangements.
The supply and use of seats in workrooms.
Facilities for washing.
Accommodation for clothing.
Arrangements for the supervision of workers.
Provision of Rest Room.

A number of Orders affecting certain trades have already been made under this section, but only one so far which applies to the wool industry.

This Order provides for an adequate supply of wholesome Drinking Water in all factories in which 25 or more persons are employed. It must be taken from the public main or some other source of supply approved in writing by the Local Authority. The supply must be labelled "Drinking Water," and unless the water is delivered in an upward jet from which the worker can conveniently drink a suitable cup or drinking vessel must be provided at each point of supply. This is the first time so far as I am aware in Factory Legislation that drinking water is required to be provided for the worker at the factory.

Considerable discussion, as many of you are aware, has already taken place in regard to the provision of mess-room accommodation and means of first-aid for those employed in the wool industry; so far no Order has been made which applies to wool. I believe the Wool and Allied Trades Joint Industrial Council is considering the H.O. proposals in this respect at the present time.

Recognising that capital is invested in the equipment and running of a wool mill with the anticipation of making a profit, I venture to say that if such mill is at its start thoroughly equipped in conformity with the Acts it stands in a better position to make more profit than if started without due regard to the law's requirements. The health, comfort, and safety of the employed undoubtedly means a full output from the plant.

REFERENCES.

[1] Order of Secretary of State, made 4/2/1902.
[2] Report on Conference between Employers, Operatives, and Inspectors concerning fencing of machinery and prevention of accidents in woollen and worsted mills. (Price 1d.)
[3] Order of Secretary of State, No. 1293, made 12/12/1905.
[4] Order of Secretary of State, No. 1287, made 18/12/1908.
[5] Order of Secretary of State, No. 679, made 24/8/1906.
[6] Order of Secretary of State, No. 1312, made 23/12/1908.
[7] Order of Secretary of State, No. 1103, made 17/10/1905.
[8] Order of Secretary of State, No. 1617, made 24/10/1904.

DISCUSSION.

Mr. R. J. H. **BEANLAND** (Clayton West), referring to the regulations with regard to periodical limewashing, said that various kinds of water-paint were now being used because limewashing was detrimental in a factory. Did water-paint comply with the requirements of the Act?

Mr. E. T. **HOLDSWORTH** (Bradford) said a friend of his had used enamel paint on his walls until they were now practically enamelled bricks. In such a case would not occasional washing down with soapy water comply with the requirements of the Act? It had been deliberately done to save damage by the splashing of machinery and material with limewash.

Mr. G. A. Taylor (Bradford) referred to the practice of some occupiers of factories of using vacuum cleaners on the walls, ceilings, machines, and floors, and asked whether it would not be a wise step on the part of such firms—since there were so many objections to lime washing—to combine themselves for the purpose of asking the Secretary of State to say that where vacuum cleaners or a vacuum brush was used it would be sufficient to do the limewashing say once in three years. Where the vacuum principle was used to remove dust and deleterious matter from the walls and floors it might be possible to get a concession on the regulations requiring limewashing every 14 months.

The Lecturer, in reply, said that exceptions had been made in regard to water-paint when the material used was approved by the Secretary of State or the Chief Inspector. There were various kinds of water-paint—good, bad, and indifferent—but there was a standard set down by the officials at the Home Office, and if the matter were put before the local Inspector he would be able to make the enquiry and find out whether the suggested water-paint was up to the standard required. With regard to the painted bricks, it was provided that where walls were painted it was only necessary to repaint once in seven years, but the walls must be washed down with water every 14 months. The point which Mr. Taylor raised with regard to vacuum cleaners was a good one. The Secretary of State had power to modify the regulations with regard to periodical limewashing when there were special circumstances to justify it. In the case of those factories which used vacuum cleaners every three months, it might be possible to get a concession under which the limewashing need only be done once in three years. Limewashing was a bugbear where there was valuable machinery, and the sooner they could get something to take its place the better it would be for the trade. In Lancashire, many mills were bricked to the height of about 5ft. 6in. all round and he was assured that it was quite a paying proposition to do it that way. It always left the trouble of the ceiling, however; where the ceiling was under 20 feet in height the periodical limewashing applied.

The Chairman, referring to the lecturer's remarks about planning a factory, said that within the last three weeks he had come across a machine maker who had received a request to lay out a plant on paper. The firm said that they would look after the walls being built round it, but they wanted the machinery laying out under the most efficient conditions, taking into account the health and safety of the employees. So far as the woollen trade was concerned, he knew that the use of enamelled or glaze bricks was very beneficial, particularly in the teasing rooms where there was a large variety of fibre and of colour. Often there were complaints of barry pieces and intermixed colours. When the complaints were investigated, it was sometimes found that the trouble was caused by a previous batch which had gone through the room and had left hair and fibres hanging about the walls. These were picked up by the next lot and became mixed in. Papers such as they had had from Mr. Wright were exceedingly helpful, and if they would pay particular attention to the points raised they would save themselves a lot of little worries and anxieties.

Mr. Beanland proposed a vote of thanks to Mr. Wright, and said he well remembered the day when the factory inspector was looked upon with something akin to suspicion. Now, however, they looked to the inspectors for help, and they could do with still more help from them. He felt sure that, as a rule, firms were most anxious to remedy defects which the inspector was able to point out. With regard to the guarding of machinery, it was often the minor things that caused accidents. He remembered once in their works they had an epidemic of spells in the children's fingers, and, eventually, he found it was caused by some lockers near the frames becoming old and worn. The operatives ran their hands along the lockers as they went along the frames and in that way got the spells. When the lockers were removed there was no more trouble.

Mr. G. S. Pollard (Bradford) seconded, and said that a previous factory inspector who had been a friend of his had told him that he had found firms as a rule very anxious and willing to do everything reasonable to contribute to the comfort and safety of their workpeople. There was now a new spirit amongst factory inspectors and a different attitude all round towards the problems which arose. With regard to the welfare side of the recent legislation, he did not think there was any active opposition to it in the trade. The provisions of the Act would have to be modified to some extent, but if the representatives of the trade and the Home Office could get together he believed they could formulate suitable schemes for all sizes of factories. It would be more easy with regard to large factories than to small ones, but the general feeling was that these things should be done.

Mr. WRIGHT, in responding, mentioned that the number of accidents arising from the use of machinery in the textile trade had now been reduced to 6·5 per 1,000 persons employed per annum. That showed what could be done, and he believed the figure could be still further reduced. Every report of an accident was carefully analysed with a view to ascertaining the part of the machinery which caused the accident. It was only by such methods that they could really find out where the danger occurred.

SOUTH OF SCOTLAND SECTION.

Meeting at Galashiels, 11th November, 1921, Mr. R. S. Hayward in the Chair.

THE PRINCIPLES OF ORGANISATION AND MANAGEMENT.

By WALLACE ATTWOOD.

Organization is the proper adjustment of the relationship between human beings in an effort to accomplish certain definite ends. The degree to which this adjustment is correct, logical, and on sound lines determines the resultant success of the organization. It is animate rather than inanimate. A business is a living, pulsating organism, which should function methodically, without confusion, delay, or misinterpretation, yet with a flexibility which allows for the initiative of the individual. Good organization implies clearly-defined plans and ideals, and efficient co-ordination and co-operation of capital, labour, and management in carrying them out.

Good management will look to the development and direction of the great sources of power in the personnel of the business, so that each member contributes his quota to some constructive plan. The resultant should be the exact control of the business, so that there shall be the maximum of efficiency.

The ideal of an efficient organization is, then, that of man-building. Surely this is high enough; but in order to make the ideal practical of attainment it must find expression through a type of organization which will recognise and apply correct principles, laws, and rules.

THE IMPORTANCE OF SOUND ORGANIZATION.—The evolution of industry and commerce has long since carried us beyond the limitations of the one-man business. Business activities are now extremely complex, whether looked at from the standpoint of a single business or industry, or the interplay between associated industries—national or international. Without proper organization there would be chaos. There is no doubt that the conditions which present themselves so plainly to us in the aftermath of the war will force efficiency in organization and management. We must organize ourselves for action, just as we did during the war. Industrial conditions will not be stabilised by a single influence, but only through the adoption of a programme of constructive betterments by each industrial concern.

There is a remarkable lack of knowledge of what we might term "the mechanics of organization." Most organizations are a good deal like Topsy, who "just growed." Capital, labour, management—it is the co-operation of these three, through sound organization, that tends to the greatest success in modern business. Since the flow of influence in an organization is from the top downwards, it is evident that increased efficiency will be most quickly secured by applying efficiency principles in the first place to the personal operations of executives, managers, and so on. It is important, therefore, that the elements of good management must provide for :—

(1) The systematic use of experience.
(2) Economic control of effort.
(3) Promotion of personal efficiency.

Coming more strictly to the ideal business organization, we must so construct it that we have :—

(1) Management and Men working in complete harmony.
(2) Centralization of functions that group themselves naturally.
(3) The Line of Control, Authority, and Responsibility, operating from executives downwards—avoiding (*a*) divided authority, (*b*) duplication, (*c*) bottle-necks, (*d*) blind alleys, and (*c*) breaches or misfiring.
(4) No man responsible to more than one superior for the same function.
(5) Pyramidal support from the bottom upwards.
(6) Co-operation and co-ordination inter-departmentally.
(7) Elasticity which will allow for the expansion of the business
(8) A line of progress which will allow for the growth and initiative of the individual.
(9) The three-positional plan whereby each person is (*a*) carrying out his own work, (*b*) training the man below him, and (*c*) understudying the man above him.
(10) An organization which will give expression to the personality of the business.

THE PURPOSE OF ORGANIZATION.—When an efficient organization has been created in a business, department, or section, we may expect it to

(1) Co-ordinate all the functions of the business to one end—that of rendering efficient service to the community we are seeking to serve.
(2) Keep the business in touch with all outside developments.
(3) Define clearly the functions of each activity within the business.
(4) Carry out the clearly defined policy and ideals of the business.
(5) Give scope for growth for every individual in the business, and, by expansion, to create openings for further helpers.
(6) Give the square deal to Capital, Management, Labour, and Customer.

THE SCIENTIFIC METHOD FOR EXECUTIVES.—To be properly organised, a business must be run on scientific lines. It is important, therefore, since the organization is no stronger than the combined efforts of the individuals composing it, that each person—and more especially the executives—must carry out work by scientific methods. Business activities to-day demand exactness and standards by which to measure achievement. Such standards must cover the individual, the products, the methods, and the working conditions. The scientific method calls for an enquiry into the ratio between practical accomplishment and theoretical effort.

The executive must

(1) Set standards for every unit in the organization.
(2) Plan all work intelligently; in general, for long periods ahead, and down to the minute detail, for early accomplishment. Then stick to the plan.
(3) Prepare all working conditions so that every facility is available for the successful accomplishment of the work to be done.
(4) Compile accurate records with a view to confirming work done and as assistance for future activities.
(5) Limit the amount of detail work for himself, thus leaving him free to control, analyse, and supervise the work of others under him.
(6) Make known where the responsibility and authority of those under him begins and ends.
(7) Standardise the duties of his subordinates and place these duties in the hands of those competent to handle them.
(8) Organize his work so that his absence for a time will not be felt.
(9) Work always on the law of exception, investigating good work to praise and inefficient work to remedy defects.

(10) Build always on a firm foundation. Have a positive knowledge of each task.

THE NEED FOR UNDERSTANDING MEN.—Men who know how to get the maximum results out of machines are common; the power to encourage the maximum from subordinates is a much rarer possession. But when we deal with men we are confronted with a complex problem. Even when we have made a study of psychology, or the laws governing mentality, we have in each individual to deal with his temperament and his personality. Executives should seek every opportunity to study mankind in general, and in particular the men under them. It is one of the main functions of the executive to discover the aptitudes of each individual under his care, and see that he obtains a certain versatility in the duties given to him which will bring out his aptitudes. At any rate, these aptitudes must be discovered and developed. We cannot afford the economic loss due to wasted man power. It is not fair to the man, the business, or the country. In a sense, he has a right to look to you to help him to discover himself. Each worker must be happy. You must understand his weaknesses, and watch out for the trouble he may cause. Encourage his good points, and deal with his faults. The whole essence of the art of management lies in the proper understanding and proper dealing with men.

ALLOCATION OF FUNCTIONS IN THE SUBORDINATE POSITIONS.—Having sized up the organization at your command, your best step will be to consider the functions for which you are responsible. Where an executive occupies a position which is subordinate to that of the head of the branch, then his next step will be to confer with his head and obtain a clear understanding as to the particular functions for which he will be held responsible. He will then be in a position to allocate such functions to himself and to his subordinates in accordance with the organization under his control.

In this allocation of functions and duties you should bear in mind the following points :—

(1) Avoid the undue concentration of duties or authority at any one point.

(2) Have in mind the average man who will have to carry out these duties, and do not put on too great a load for the average man to carry.

(3) Arrange for the hardest tasks to be taken care of as well as the easiest.

(4) Make it possible for duties to be performed in a way that will yield the greatest returns in the shortest time.

(5) Each sub-section, group, or branch should be so arranged as to contain all the factors which will effect the performance of its particular functions. Only in this way can each subordinate be held strictly responsible for the successful accomplishment of the tasks allocated to him. In addition, this greatly reduces the amount of supervision required, and also tends to develop and strengthen the subordinates.

(6) Allocate the functions so that you are in a position to deal with any task in its elementary parts rather than in large units.

DEPUTING.—By preparing very carefully the foundation of the organization, personnel, etc., you have a clear course as to how much is to be deputed, who would carry the load for you, how this would be carried out, the points at which you can check up accomplishment, and so direct the energies of your subordinates. In deputing, endeavour to keep your subordinates as far as possible on the highest kind of work of which they are capable. In giving orders or instructions, see that you amplify them, giving the reason for which the work has to be carried out, so that you arouse interest in the worker and give him ground for self-respect in accomplishing the task. Encourage him to take pleasure from his work, as it gives him an outlet for his energies and an opportunity to demonstrate his mastery over the task.

Naturally, you will have an objective in all your plans. Let your subordinates know what your objective is. See that the juniors get versatility in the tasks which are handed out to them, so that they may broaden their experience in the department's work. The evolution from the junior to the executive is that he should " first learn something of everything, and then learn everything about one thing."

Develop the habit of letting go your detail work. Occasionally, have a sort of " spring clean " with regard to your daily work; ask yourself why you are doing certain tasks and if there is anyone among your subordinates who could be trusted with it. Remember that you are expected to keep the reins in your hands. You have authority over your subordinates, and in final analysis must take the responsibility for the work with which you entrust them. See always that you keep at least 1% of anything that you depute in your own hands. Remember that work is most easily controlled at its origin and checked at the pivotal points or at completion. Orders or instructions communicate authority from you to those under your charge. Reports on accomplishment discharge the responsibility of a subordinate to you. Arrange for information to come through automatically, rather than as a result of your own personal effort in collecting it. Don't let work drift along at the comfortable level of the average mind.

The principle that authority and responsibility should coincide is often lost sight of. Responsibility cannot be developed in individuals unless they are given specific authority. Obviously, responsibility for good or bad accomplishment cannot be fixed unless the authority be clearly defined and responsibility made to coincide. Inability to fix responsibility clearly and justly for acts that have already taken place is without doubt one of the greatest enemies of organization.

TRAIN, DIRECT, AND SUPERVISE.—A point is ultimately reached in the expansion of any business when the personal relations that existed between the master and the man no longer obtain, and these must be replaced by organized effort. Business men are fast waking to the fact that the greatest problem that confronts them is the man problem. This has been brought home more forcibly in recent times because

(1) We are passing from an industrial period where the greatest economies have been effected by labour saving devices to one where human ingenuity is necessarily devoted to a finer organization of business;

(2) we are realising that mechanical invention economies cannot proceed indefinitely, nor can the utmost values be obtained therefrom without dealing with the human factor in whose hands the economies are really effected;

(3) we realise that an organization is an organism pulsating with energy that needs direction;

(4) we appreciate the principle that man is the cause of which all else in industry is an effect, and that the success of any business is no greater than the sum of the successes of the people in it;

(5) investigation has proved our general ignorance of the content and potentiality of the human factor;

(6) we find too great a turnover of workers, much of which is due to our lack of appreciation of the versatility of human talents, to the lack of adequate training and proper employment plans;

(7) of the great upheaval brought about by the war and its attendant circumstances;

(8) much of the present unrest, in final analysis, is due largely to the maladjustment incident to subordinating one human will to another, especially when it is accompanied by work conditions which tend to repress the development of the human personality.

Executives are continually complaining of the meagre equipment and indifferent attitude of the juvenile recruits towards work, and the consequent large turnover and instability of workers, resulting in a serious lack of highly skilled workers and a shortage of competent men for the posts of full responsibility. To-day, industry must not bear the cost of human depreciation but assist in preventing it. We must, therefore, create the best possible work environment for discovering and training human aptitudes. Industry is continually looking for ability. Industrial training, vocational guidance, and scientific management are but successive phases of the same problem—which is to make every member of the organization an efficient industrial and social unit. The problem, then, is to develop the man, and the supreme function that of the conservation of human energy.

TRAINING THE WORKER.—This question of training is but a part of the larger question of vocational guidance, which implies the proper selection of employees and the training and application of their talents. It forces us to comprehend the physical, intellectual, and moral worth of each worker. It calls for readjustments in education and work opportunities that will establish, maintain, advance, and defend individual freedom, and thus enable a man to make the most of himself. Work environment profoundly affects the welfare of all people. Work is the chief training school of life. Training is the means by which fitness is most quickly and easily acquired. Vocational guidance should be, as far as possible, a matter of self-direction, through the creation constantly by the executive of the right kind of opportunities. Workers are entitled to direction and training in addition to their weekly wages. Each individual, as he proceeds through life, has continually to be making choices as to the best direction in which to apply his energies. He needs health, income, progress, sociability, and opportunity for wholesome constructive leisure, and in these democratic days it is all-important that he should have his sense of justice satisfied.

The significant influence of the rise of the human factor in business relations is seen in many directions—(1) In the distracted and torn conditions in which society finds itself to-day; (2) in the conflicts between Capital and Labour; (3) in the dissatisfaction among business men with our educational output; (4) in the discontent in the educational sphere with what industry has to offer to the workers; (5) in the grave criticisms coming from without, because of the social burdens forced upon society by the unemployed—created in large part because they were first misemployed, then under-employed, then unemployed, and finally made unemployable; and (6) at the same time the increase of wealth, the spread of all forms of education, the growth of political democracy, and expanded freedom in many directions have vastly enlarged the horizon of the worker.

THE OBJECTS OF TRAINING.—In training the men under your control, you should bear in mind constantly that you have to develop heads as well as hands. Routine workers must perforce have to deal with tasks which are beneath them in quality, but you must show how, by intelligent thought, even routine work can be made a problem of method. Encourage each worker to entertain a just respect for his work. Keep accurate records of performances by workers. Familiarise each worker with the qualities which you consider ideal for his job; then inspire him to strive for their development and attainment. Study each worker in relation to his task, and find out the causes of his success or failure. Praise the former, and give constructive criticism with regard to the latter. You must help the worker to think, to be orderly and logical in his processes of thought, to be accurate in his observations and discriminating in judgment.

Set ideals for your staff. Develop departmental pride, but let it conform to the ideals of the business. Get some soul into the work and develop team work. Awaken the consciousness of service whereby each realises that all good work satisfies the wants of others.

Let there be an observance of the spirit as well as the letter of the rules which govern business relationships. Encourage each person to think, feel, and work on the positive side of life. The future and not the past is always the banner to float before aspiring workers.

Opportunities for the worker must be created. See that workers are not overlooked or overworked. Make it possible that there shall be nothing between a man and success except himself. Make sure that the man most capable and efficient in a certain kind of work will get that work to do. Development of character is most important so that each worker may the better be able to engineer his life to greater happiness.

DIRECTION AND SUPERVISION.—The executive must fill his own position properly before he can expect to have the substance of authority rather than the mere shadow which his position gives him. Real authority comes in a large measure from actual knowledge of the functions, activities, duties, and tasks over which the executive exercises control. The big work for executives is not that which has to do with factories, plant, manufacturing, figuring, or merchandising, but that of man-building. You will get bigger returns for the time and effort spent in developing your workers than the same time and effort spent on the inanimate things of business. Take up the study of man, and commence with yourself. Train yourself to get down to the level of each individual under you. Start from his viewpoint, and, working from this, bring him round to the business viewpoint, which, on right foundations, should mean finally the best interests of the man himself. The object of all training should be to increase the usefulness of the worker—usefulness to himself and others.

FUNCTIONS OF MANAGEMENT.—Some executives work incredibly hard, live a strenuous life, and never have a minute to themselves. Time and energy are dissipated over little things. Such an executive is continually answering the demand of a disorganised business. He is at the beck and call of everyone with whom he deals, each supplied with a weapon of the executive's own forging which is being used against himself. This is one of the most harassing positions in which an executive can find himself. The true executive is gauged by his ability to control, judge, plan, and execute. Sound judgments and correct decisions are the keynotes of the test. The executive's job is primarily a thinking job; he is dealing with forces rather than with things or systems. The business man of small calibre knows little or nothing of these fundamental forces. Business is becoming increasingly more exact, more scientific, and therefore more professional. I have endeavoured to show that organization and management can be based on laws and principles, causes and effects. Business management is a profession.

Extraordinary as it may seem, business is the only profession that a man can enter without previously preparing himself for it. A man cannot become a doctor, a lawyer—he cannot even become a stonemason or a carpenter—without previous preparation. But he can slip into business no matter how inadequately prepared he may be in the science of business. Real executive power will not just come to a man —he must study and train himself for the position.

Administration is a "thinking" job. The true executives of to-morrow and of the future are going to direct more and more on the basis of scientific knowledge rather than on the basis of tradition or precedent.

The lecture was illustrated with a time and motion-study film showing the different motions used by workers in performing similar work.

In proposing a vote of thanks, Mr. JOHN HUTCHESON said it would be by better organization and management that future success would be obtained. He felt sure that all present would benefit from Mr. Attwood's lecture.

INDUSTRIAL FATIGUE RESEARCH BOARD.

PROPOSALS FOR DEVELOPMENT OF INVESTIGATORY WORK IN RELATION TO THE TEXTILE INDUSTRIES.

An inquiry has recently been submitted to the Textile Institute, from the Government Industrial Fatigue Research Board (per Mr. D. R. Wilson, the Secretary) as to whether the Institute could take steps to secure the co-operation and financial support of the various organisations in the textile industries so that the work of the Fatigue Board in reference to the textile industries could be extended and developed under the more complete control of the industries themselves. The Council of the Institute elected a special committee to consider the matter, with the result that a circular-letter is to be issued to various organisations, including research associations, with a view to ascertaining what measure of support is likely to be forthcoming for the movement. If the replies are adequate, it is proposed to call a conference of representatives of the various interests to consider the whole matter. On the suggestion of the Institute Committee, the Secretary of the Industrial Fatigue Research Board has prepared a Memorandum in reference to the lines of investigation which might be pursued in reference to the textile industries, as follows:—

MEMORANDUM ON LINES OF INVESTIGATION IN THE TEXTILE INDUSTRIES.

The Memorandum is divided into two parts, the first dealing with the work completed or in hand in the textile industries, and the second with suggestions for future lines of research.

I. WORK COMPLETED OR IN HAND.

The work hitherto undertaken by the Board in the textile industries has been concerned principally with the weaving sections of the cotton, silk, and linen weaving trades. It may be briefly summarised as follows :—

(1). *Cotton.* Apart from two Reports (Nos. 7 and 8), embodying the results of subsidiary inquiries, the main investigation under the control of Mr. S. Wyatt, M.Sc., has consisted in the collection at short intervals of output data from a large number of looms in different sheds, with a view to studying the hourly, daily, weekly and seasonal variations and their causes. The collection has extended over a complete year (ended December, 1920), and a large amount of material is available which is now being embodied in a report.

In addition, numerous observations have been made on the physiological effects of atmospheric conditions in weaving with the object of ascertaining the practical optimum conditions and how far these are obtainable.

The investigation has been concerned almost wholly with weaving, though one of the reports referred to above (No. 8) deals with bobbin-winding.

(2) *Silk-weaving.* An investigation on very similar lines but on a smaller scale was carried out by Mr. P. M. Elton on silk-weaving, and is published as Report No. 9. Several important practical points have been elucidated such as the effect on production of artificial light as compared with daylight.

Quite recently, a second report by Mr. Elton has been presented to the Board by Messrs. Grout & Co., Great Yarmouth, and is now in course of publication. It is based on results obtained from an intensive study of individual weavers, in silk-weaving, but the general principles are applicable to power-loom weaving in any of the textile trades. By an analysis of the different causes of loom stoppage and observation of the time taken and of the methods adopted by different weavers in dealing with them, the author shows how exactly a good weaver differs from a poor weaver in method and advocates a preliminary course of training which would tend to make all weavers more equally efficient. A further point established is the great extent to which production in silk-weaving depends on the human factor.

(3) *Linen-weaving.* For the weaving of certain kinds of linen a higher temperature and degree of humidity is required than for cotton weaving, so that a specially good opportunity is afforded for studying the relations between atmospheric conditions, and fatigue and efficiency. With this object an investigation (on similar general lines to that in the cotton industry) has been carried out in two Irish weaving sheds by Mr. H. C. Weston.

The Report, which is not yet published, contains several conclusions of importance. In particular, there are indications of an *optimum* relationship between temperature and efficiency corresponding with a point which is high enough for weaving and not too high for great physiological discomfort. The effect of artificial lighting on output also is shown to be similar to that in silk-weaving.

II. POSSIBLE FUTURE INVESTIGATIONS.

The following suggestions are merely examples of many that have reached the Board during the last three years.

(1) *Artificial humidity.* A question which has been before the cotton trade for the last 25 years and is still unsettled is that of the effect of artificial humidity in weaving sheds. Two methods of investigation here suggest themselves :—

(*a*) Collection of sickness, &c., records in order to ascertain the extent to which artificial humidity affects the operative.

(*b*) Study of the optimum conditions in weaving, or the conditions which produce the best results, having regard to the effect on (i) the operative and (ii) the warp.

A rather similar subject deserving investigation is that of the effects on the operatives of temperature in wool-combing.

(2) *Noise* at present is common to almost all textile processes. An important piece of research would be the study of the effects of noise upon the operatives.

(3) *Individual differences.* The report on silk-weaving referred to above indi-

cates that very valuable results would probably be obtained by an extensive study of the nature and causes of individual differences in weaving ability.

(4) *Training.* As the outcome of (3), would arise the question of the best method of training operatives in the work for which they have been selected.

(5) *Vocational Selection.* The question arises as to how far it may be possible eventually to select operatives according to their suitability for the different kinds of work in the industry. This would involve a large amount of research having for its object the discovery of the special capacities demanded by each occupation.

(6) *Machine Design.* This subject (the design of machines so as to take into account " ease " of working) has been touched on in Report No. 8, where two types of winding frame are compared from this point of view. The subject could be further explored in other sections of the trade, in close co-operation with textile machinery manufacturers.

(7) *Optimum length of spell, interpolation of rest pauses, etc.* The board are contemplating a general inquiry into these points and would look for the co-operation of the textile trades in the acquisition of knowledge on the subject.

In addition, specific applications for guidance on these matters were received about 18 months ago from (1) the Jute trade and (2) the Flax and Hemp trades through their respective Trade Boards. Investigation was duly approved by the Board but was postponed owing to the abnormal conditions prevailing.

There is also reason to think that the woollen and worsted trades would welcome information on these points.

The foregoing are merely examples of the more important lines of investigation which at once suggest themselves; others will doubtless arise as work progresses.

One of the great advantages of transferring the main control to an organisation representing the textile industries will be that the relative importance of these investigations will be more correctly estimated.

In many, if not in all of them, expert scientific opinion will often be necessary. It may be desirable, therefore, to point out that apart from the Board itself there are now four scientific Committees, appointed by the Medical Research Council, dealing respectively with—

(1) Statistics.
(2) Physiology of Muscular Work
(3) Physiology of Respiratory and Cardio-Vascular Systems.
(4) Psychology.

The guidance of these Committees would be available on all matters arising within their respective spheres.

Finally, there exists the National Institute of Industrial Psychology who would doubtless be prepared to assist in introducing into individual mills improved methods as these are brought to light.

(Signed) D. R. WILSON.

NOTES AND NOTICES

THE OPTIMISTS AND THE PESSIMISTS.

The hazarding of predictions as to the state of trade and industry in the more immediate future appears, of late, to have set up something in the nature of a small war of contention between the optimistic and the pessimistic contributors to the newspaper press. Mr. W. Greenwood, M.P., who is Chairman of the Lancashire Section of this Institute, made reference at the recent annual gathering of the Ring Yarn Association to a tendency which he strongly deprecated. Whilst not desiring to minimise the seriousness of the existing situation with regard to industry generally, and that connected with the cotton trade in particular, he appealed for greater care on the part of all concerned in dealing with facts as apart from opinions or speculations. He had before him a newspaper report in reference to the state of the cotton trade at Manchester. It was a report which presented a black picture indeed, and the only piece of possible encouragement contained in the record was a statement that a few "trifles" were negotiated for one particular market abroad. As he (Mr. Greenwood) knew positively that one of the said trifles represented a million pounds weight of material, he felt inclined to suggest that some people had got so accustomed to preaching "slump" that it had become a habit. He ventured the view that nothing could be more harmful to our trade than unwarranted depreciation of the prevailing conditions.

CO-PARTNERSHIP AND PROFIT-SHARING.

Mr. Theodore C. Taylor, who for some years represented the Radcliffe Division in Parliament, has been speaking to the Blackburn Chamber of Commerce on co-partnership and profit-sharing. A few years ago he addressed himself to the Textile Institute on the same subject. He is entitled to be listened to, for the Batley firm of which he is the managing director have been practising this doctrine of sharing with the workers, and over a period of twenty-nine years they have paid out half-a-million in this way. Experience thus gained must count for something, and the industrial world ought to know what results, other than merely financial, have accrued. For, after all, the successful system must be one creating more than mere financial interest; it must win the goodwill of the workers, and also of the employers. In other words, it must create and develop that spirit which moves both sides to make, in the words of Mr. Taylor, their respective sacrifice. There is tangible evidence that that spirit at the Taylor mills is as great if not greater than the purely monetary results; if it were otherwise, the scheme could not have lived into its thirtieth year. What is possible, even successful, with one concern ought to be possible, with appropriate modifications, with others. What has prevented the extended adoption of the scheme is perhaps suspicion on the one hand and some slackness on the other, and they tend to react on each other. The antagonism of interest between employer and worker may be suppositious, but the tendency of the past few years has been rather to cultivate it than to seek points of mutual agreement. We don't want the lesson forcing home by poverty and unemployment, nor by experimental socialistic legislation. Mr. Taylor points out a quicker and more satisfactory method—the unification of interests. He himself would be a good apostle of the doctrine he practises, and his aid might be sought by employers. A relay of worker-speakers from the Batley mills might with advantage be enlisted to preach the same gospel among the workers of the community. —R. C.

THE RAILWAYS AND THE ROAD.

The railways are out to get powers for road transport. Since they were refused them last year, and refused on a technicality, it was inevitable that they should enter the field boldly for this object. The road transport interests, who in the war and post-war period have grown very strong, will oppose it on the ground, to put their case in its briefest form, that it will tend to set up a monopoly and allow the companies to squeeze out the private trader. It is all a question of great interest to the textile areas of Lancashire and Yorkshire, which are intensive industrial areas and need cheap, mobile, and intensive transport. If the fears of the private hauliers are well founded and the grant of the powers to the companies results in a return of monopoly in transport, then we may be sure that industry will suffer. But it is doubtful if a monopoly will result. The extension of road transport during the war broke what monopoly the companies had, and the road conveyance of goods is now so widespread and covers so wide a range of material, that it is difficult to see it falling into hands of one set of interests. Frankly, the railways have a good case. They were the pioneers of fast, reliable transport, and, although they used their powers not always wisely, their service to the community cannot be questioned. Why should they be debarred the privilege of modernising their system? If they can use the road to advantage and co-ordinate the two services, the public is entitled to the benefit of that co-ordination. It will not kill competition; rather will it give trade further facilities, and facilities mean trade. If trade expands we shall need more haulage, enough to keep both railways and private hauliers going. That, rather than any monopoly, would suggest itself as the probable result of the granting of the powers sought by the companies. Road transport is too individualistic a medium to be squeezed out or to become a monopoly. There will be plenty of work for private concerns if they can supply cheap facilities. That is what they need to look to.

—R. C.

CONSERVATION OF OUR COAL RESOURCES.

It has long been felt that an important aspect of the great problem of the conservation of the national coal resources involves the study and classification of the coal seams which are at present being worked or developed, and also of seams or portions of seams which are being left unworked or are thrown aside above or below ground. This study and classification on its directly practical side must deal primarily with the suitability of each particular coal for those purposes for which its individual qualities render it most adequate, *e.g.*, for gas making, coke making, steam raising, or for domestic use. This question of survey has for some years been receiving the anxious consideration of the Fuel Research Board, but the unstable conditions which prevailed in the coal industry during and since the war have necessarily led to the postponement of the work of organisation. Now, however, it is considered that the time has arrived when a beginning can wisely be made. The Fuel Research Board believe that this work can be most effectively carried out with the help of local Committees in which colliery owners, managers, and consumers are associated with the representatives of the Fuel Research Board and the Geological Survey. By this combination, not only will local knowledge and experience be made available, but the initiative of those most deeply interested in the practical aspects of this Survey will be secured. The Survey work will thus from the outset assume a practical character, for the selection of seams for examination will be in the hands of those who are in the best position to estimate the relative importance of the problems awaiting solution. The selected seams will be submitted to physical and chemical examination by the local experts; and, as a result of this examination, a further selection will be made of those which appear to justify experiments on a practical scale to test their suitability for particular uses or methods of treatment. This experimental work will be carried out either at H.M. Fuel Research Station, or at other works, as may be found most convenient. The first Committee is already actively at work in the Lancashire and Cheshire district, where the local Research Association has been recognised by the Fuel Research Board as its representative body for the purpose. It is felt by the Fuel Research Board that the experience gained in the work and organisation of this Committee will be of great value in the establishment of Committees in other districts when the time is ripe for further developments, but they are satisfied that it will be wise to build up this national organisation on the sure foundations of actual experience.

THE LATE SIR EDWARD TOOTAL BROADHURST, BART.

Profound regret has been occasioned thoughout textile interests generally by the announcement of the death of Sir Edward Tootal Broadhurst, Bart., which took place in a Leeds nursing home on the 2nd February. The whole movement associated with educational activities and technical and scientific advancement in connection with the textile industries and the cotton industry in particular has lost a notable supporter. Sir Edward was a foundation life member of the Textile Institute, and the firm which bears his name, Messrs. Tootal Broadhurst, Lee Co., Ltd., contributed £1,000 to the endowing Foundation Fund of the Institute. His demise came with marked swiftness at the age of sixty-three years, and in no circle will the regret be keener than in that which embraces the membership of this Institute.

GENERAL ITEMS AND REPORTS

VEGETABLE FIBRES OTHER THAN WOOL AND COTTON.

Mr. A. WIGGLESWORTH, lecturing before the Bradford Textile Society, on Monday, January 9th, on " Research in Fibres other than Wool and Cotton," said he confined his observations to the group of fibres which were employed in the manufacture of linen, canvas, bagging, twine, ropes, &c., chief amongst which were flax and hemp. The range was a wide one, however, and included jute and a variety of other fibres. Almost every plant produced some kind of fibre, and natives of foreign lands had perforce learned how to extract and make use of those most accessible in their own region. Pioneers had profited by their experience, and during the last half-century had introduced into Europe many such fibres which were in common use in other lands, as, for instance, sisal hemp from Mexico; Manila hemp from the Philippines; Indian hemp and jute from India; rhea or ramie from China; and New Zealand hemp from New Zealand. In trade circles, these fibres were broadly classed as " hard " and " soft." The former group embraced Manila, sisal, and New Zealand hemp; the latter flax, the true hemp, so-called Indian hemp, jute, &c.

The consumption in the United Kingdom of these fibres was about 100,000 tons, of which about 70 per cent. was imported from foreign countries outside the Empire. These figures showed that the fibre resources of the Empire remained almost undeveloped and there was no reason for confining so much of our purchases to fibres procured from countries under foreign domination. It was safe to say that East Africa could supply the entire need of the British Empire in fibres if consumers would adopt sisal in place of Manila for the manufacture of binder twine and ropes.

The enormous shortage of flax caused by the defection of Russia, which formerly produced about 700,000 tons per annum (more than three-quarters of the world's total supply), had caused a very serious problem. The climax had been staved off by the closing down of a great many mills, owing to the world depression, and by a reduction in working hours in other mills to 25 hours in place of the 45 hours permitted and the 55 hours in vogue before the war. Consequently, the shortage of production of flax had not so far been seriously felt, and there might be time to encourage the production of flax in other areas.

In this connection, much research work had been done during the last few years, and he himself had been responsible for the introduction of the cultivation of flax into British East Africa (Kenya). Whereas this article was unknown there prior to his visit in 1913, there were to-day over 30,000 acres under cultivation, and the quality of the flax produced was considerably better than anything turned out in Russia. The climatic conditions in the uplands of Kenya, at an altitude of 8,000 to 9,000 feet, were suitable to the production of a good medium class of flax providing that the rainfall did not fail, and as land in that area was at a low rental, and in addition native labour had proved extraordinarily efficient in learning the intricate work connected with the preparation of flax, while wages were low, there was every reason to believe that there was a future for the extension of the cultivation of flax in the upland districts, not only in Kenya, but in Tanganyika, Portuguese East Africa, and no doubt also in certain areas of the West Coast of Africa. It was quite possible that the energy spent at home would be better applied to the cultivation of these fibres in our African Colonies, so that we might build more and more upon the cheap native labour and use the Colonies as a feeding ground to establish this country as the great place of manufacture.

Sir Henry Wickham, who first brought the seeds of para rubber to the Federated Malay States, had penetrated South America in order to procure the roots of an unidentified plant from which had been prepared a fibre which appeared to stand midway between hard fibres (such as sisal) and flax. Three months' mule ride from the coast he had discovered boundless tracts of this material. It could be divided into very fine filaments by special treatment and spun into fine yarns where formerly only flax or the finer Italian hemp could be employed. He was perhaps giving away a secret in mentioning that this material (known as Arghan fibre) was at present the subject of a very interesting research with a view to ascertaining the best means of separating the cuticle from the fibre. Seeing that the plant contained some 20 per cent. of fibre, as compared with 3 or 4 per cent. in sisal, its immense possibilities might be at once grasped. An acre of flax produced from 2 to 5 cwts., but an acre cultivated with this new plant promised a production of 10 to 20 cwts. It was necessary to find out whether it could be grown in other countries and which countries were best suited to its production. Something of that kind might save the linen trade from the debacle in Russia, because Russia might not recover for a long time.

He would like to plead for a closer co-operation between the scientific and the industrial mind. Labour played so important a role in flax and hemp culture that an increase in its cultivation could only be looked for in those countries where abundant and cheap labour abounded. Africa and Asia were likely to extend flax. Europe must curtail production, except where a very high-class article could be prepared.

With regard to the soft fibres, the parent plant, hemp, was still by far the best prepared and most useful textile in the hemp line. There was room for experiment, however, in obviating the disagreeable work entailed in removing retted hemp from the stagnant water pools which were employed in Italy for retting purposes.

Although sisal was one of the more recent fibres, there had been more research work in connection with its production and preparation than in the case of any other fibre. There could be little doubt that the East Coast of Africa was likely to prove the centre for the finest quality of sisal fibre at the lowest prices, as cheap labour, low land rental, and climatic conditions were all in its favour.

Ramie was a fibre full of possibilities, but there did not seem to have been sufficient co-operation between laboratory research and practical production. Bradford circles knew this fibre, as it could be used as an admixture with both wool or cotton.

During the war Germany had been forced, through the absence of fibres, to substitute such articles as the nettle for flax and paper for jute. The experiments had been useful as they had gone to prove that nothing was known at the present time which could satisfactorily take the place of the fibres which were now used, and most of these war-time articles had already been abandoned.

In the course of the discussion artificial wool was mentioned, and Mr. Wigglesworth said he had seen laboratory specimens of artificial wool made from jute which he believed would be quite satisfactory for mixing with wool, but he had never seen it done on a commercial scale, and until that could be done, he did not think the problem was solved. Even supposing it could be solved, he was totally opposed to the mixture of jute with wool. In wool, they had the highest lasting virtues of any fibre, and in jute the very lowest. Jute perished after two years under normal conditions; exposed to sunlight, in half the time; exposed to water, in a quarter of the time. To use good wool along with such an inferior fibre was, in his opinion, a degradation of the wool fibre, and should be discountenanced. There were some fibres which might be used in that way. For instance, ramie produced one of the most lasting and beautiful fibres. With regard to the production of flax at Selby and Yeovil, he was very pleased that the work was continuing, because previously the production of flax had languished in England. He had recently seen flax produced in England which was just as good as any Belgian flax. —M.

COTTON INDUSTRY PROSPECTS FOR 1922.

Writing on this subject, Sir Charles Macara, Bart., has much to say to the "Jeremiahs" who, it is said, see nothing but disaster ahead in regard to the exports of British cotton goods to India and the Far East. He asserts that India will not be able to add appreciably to her spindleage for long years to come, and that Japan has not the machinery to rob us of our Indian markets. "Agitators or no agitators," he adds, "India is bound, sooner or later, to turn to Lancashire for help if the majority of her population is to be clothed at all. If our home trade calls for the product of twelve million spindles, how is India, with little more than half the spindles we need for our own use, to supply a population seven or eight times as large? Remember, too, that India has taken nearly a century to get seven million spindles, and that in years when there was no difficulty in obtaining machinery. It is unlikely that the world in future will be satisfied with a reduced standard of clothing, and seeing that cotton, it is estimated, clothes nine-tenths of the people of the world, and is by far the cheapest of clothing, and that before the war the trade was developing at the rate of four million spindles a year, I cannot but be fortified in my opinion that cotton will soon come into its own again."

REPORT ON THE INDIAN PIECE GOODS TRADE.

An exhaustive analysis of the Indian piece goods trade is made by Mr. A. C. Coubrough, C.B.E., in the sixteenth number of Bulletins of Indian Industry and Labour. The writer illustrates by means of graphs the total consumption of piece goods in India, the average price of piece goods, the quantity and value of imported and India mill piece goods, and the annual profits made by Indian mills, during the period 1909-21.

The pre-war consumption of piece goods varied from 400 to 530 crores of yards, the average being about 480 crores of yards. Demand declined steadily during the war, reaching the lowest point during 1919-20 with 300 crores of yards. The following year trade improved and 403 crores of yards were disposed of. The amount of piece goods imported fell from 310 crores of yards in 1913-14 (a boom year) to 100 crores in 1918-19, and to 96 crores in 1919-20, increasing to 143 crores of yards in 1920-21. During the same period the production of Indian mills increased from 106 crores of yards in 1913-14 to 143 crores in 1920-21, suffering only a small relapse during the bad year 1918-19.

Indian millowners increased their production to the greatest possible amount during the war, but, owing to the impossibility of importing machinery, the limit was reached shortly after the outbreak of war. The influence of high profits in speeding up production is shown by the fact that whereas the number of looms in Indian mills only increased by 15 per cent. between 1914-20, the output of woven goods increased by 46 per cent. During this period, prices at times reached three times their pre-war value, while wages rose about 58 per cent. and standing charges remained stationary. By 1921 the value of factory made goods was 68 crores of rupees—about four times the value of the pre-war output.

An interesting feature of the report is the light it throws on the size and importance of the domestic industry. In 1913-14, 114 crores of yards of cloth were manufactured on handlooms; in the following year the output increased to 130 crores; during 1917-18 it fell to 85 crores of yards; rising to 113 crores in 1918-19, and 117 crores in 1919-20. These figures show that up to the present time the handloom is maintaining its position in the native industry despite the competition of the power loom.

In discussing his results, Mr. Coubrough points out that there is little competition between imported and Indian cloth. In 1920-21 of the 400 crores of yards consumed in India the amount of imported piece goods of a similar character to those produced in the country was less than 40 crores of yards.

Another point revealed by this investigation is that the average amount spent on piece goods remained practically stationary for some years before the war. With the rise in prices during the war, imports declined steadily, and Mr. Coubrough attributes this to the fact that importing merchants in India are only able to dispose of imported piece goods to a certain annual value, which he estimates at 44 crores of rupees. The year 1920-21 he considers abnormal, merchants being committed to an expenditure of 80 crores of rupees. The explanation of this is to be found in the fact that the merchants arranged to buy goods for which they expected to pay about 50 crores of rupees but, as their contracts were made in sterling, the fall in the value of the rupee has increased their obligations to 80 crores of rupees. Mr. Coubrough points out that although goods to this value have been imported a great portion of them are still lying in Indian docks. --F. C

FAULTS IN DYEING WOOLLEN AND WORSTED PIECES.

A discussion on this subject took place at a meeting of the Huddersfield Section of the Society of Dyers and Colourists on January 13th, Dr. L. Gordon Paul presiding.

Mr. James Hollingworth said that he had not yet been persuaded that it was possible, except in a few isolated instances, for a dyer to create a listed piece. The fault was regular throughout the piece, the lists being either lighter or darker as the case might be, and he did not see how that could occur with a piece running in irregular rope form over the winch of the dyeing machine, when the list might be exposed for a few yards and then wrapped inside the body of the piece. If a manufacturer were using an oil containing an excess of unsaponifiable matter, or an inferior insoluble size, there would certainly be trouble for the scourer, finisher, and dyer. When pieces containing such impurities were put through the crabbing process, there was a liability to cause a listed piece, because in that process the greatest pressure in the crabbing rollers was in the middle or body of the piece, and this would squeeze the impurities towards the lists and thus affect the subsequent dyeing. With regard to flecked pieces, he could not say in this case that the dyer was beyond criticism, but the majority of flecked pieces were the result of imperfectly prepared pieces as received by the dyer. In the case of woollens and woollen weft goods, a cheap blending oil used in the teazing room could cause untold damage. Careful supervision in preparation in the scouring and milling room was also essential to avoid flecked pieces. The scourer needed a soft water, Brunner Mond's alkali, a good soft or hard soap, and ammonia. With regard to the question of the dyer's responsibility, given a good clean piece, there was no reason why the dyer should not produce a level-dyed result, if ordinary precautions against mishap were taken. Most dyestuffs required starting at a low temperature and gradually raising to boiling point. A few, such as Alizarine Brown or Khaki Brown, dyed by the one bath method with chrome, in the same bath, required a higher temperature at the start. If the temperature of the bath became too low, the tendency was for the colour to fall out of solution, and there must be a perfect solution or it was impossible to dye evenly. Another point to be considered was the speed of the winch dyeing machine. It was necessary to pass the goods through the dye bath at a correct speed sufficiently rapid to obtain the required level result.

With regard to stained pieces, these faults could be enumerated as oil stains, loom stains, drought stains, metallic stains, and mildew stains. In this connection, the older dyehouses were generally dingy, cold, ill-lighted and unprotected places, and it was really surprising that stains and such faults were not more frequent under such conditions. He had in his mind's eye the ideal dyehouse for eliminating drop stains so far as the dyer was concerned. It would be electrically driven, a small motor to each machine, direct drive; no shafting and counter-shafting with its cog-wheels and miles of belting throwing off grease and constant stream of rusty water. Each machine would be hooded, and the steam conducted to a central heated channel, to prevent condensation, and drawn out into the open air by a sufficiently powerful fan.

With regard to the drought stain, he was unable to say how it got its name. It usually occurred as a light-coloured stain, and was the result of the oxidation of the oil in the goods. Given proper conditions, this oxidation could become far enough advanced in one or two hours' time to cause a fault. Goods which had been in greasy or scoured stock for any length of time should always be re-scoured before dyeing. Even then the level-dyeing acid colours would be better used than the mordant colours.

Mr. E. Stapleton said that with regard to the " bagging " of pieces, that would not prevent it from being listed if listing were due to the causes Mr. Hollingworth had mentioned, whilst it would spoil the piece as a saleable article. Opening the pieces out with the aid of a stick was a very successful method, but it lowered the output.

Mr. Hollingworth said his view was that if the fault of a listed piece was with the dyer, that fault could be corrected by dyeing subsequent pieces bagged; and, also, if a flecked piece were turned out in the dyehouse, the only way to correct was to bag it, strip it, and re-dye it bagged.

Mr. J. W. Thorpe said that many firms who had had endless trouble with listing had absolutely eliminated it by means of flat or open scouring across the full width of the piece. The listing was due to unsaponifiable oil of insoluble size, which could not be got out by rope scouring, but was removed by flat scouring. This did not lessen output; twenty pieces could be done per day.

Mr. D. McLellan thought the subject was one which should be investigated by a research society, and that the attention of oil merchants should be drawn to the trouble caused by unsatisfactory oils. —M.

CULTURE OF FLAX IN IRELAND.

The results in the 53rd Annual Report of the Flax Supply Association (1921 issue, 64 pages) are complete to the end of 1920. Heavy rainfall was general over the flax-growing area and delayed the sowing of much flax seed until the beginning of May, notwithstanding which the acreage cultivated was 33% greater than in 1919. The acreage in 1919 was 95,610, and in 1920 was 127,198. The yield per acre for the whole country, however, was 12·31% less, the respective amounts in stones per acre for 1919 and 1920 being 23·88 and 20·94—both of which are much below the average of pre-war days. The gross yields for 1919 and 1920 were respectively 14,270 and 16,652 tons of scutched flax. The latter figure is an increase of 6,000 tons above the average for the ten years preceding 1913 and approximately 3,300 tons above the average for the last decade.

The imports of scutched flax for 1920 were 12,221 tons as compared with 11,967 tons in 1919, and 45,865 tons in 1913, all exclusive of tow.

Of the Irish produce, Belfast alone consumed 50% during 1920. Prices then were abnormally high, reaching as much as £408 per ton.

The number of scutch mills is not carried further than 1917, when the figure was 691, being an increase of 72 over the year 1913.

The number of spindles in Ireland in 1920 is given as 951,340, which shows a decrease of 3,831 from 1919 and approximates to the number for 1913.

Of power looms, the figure recorded for 1920—37,789—shows an increase of 188 over 1919, and of 454 over 1913.

The last return of persons engaged in textile factories in Ireland is for 1907, the Home Office figure showing 75,692 then so engaged.

The imports and exports of yarns are given below :—

	1920.	1919.	1913.
Imports	12,698,560 lbs.	2,448,320 lbs.	18,289,600 lbs.
Exports	6,979,840 lbs.	13,549,760 lbs.	21,931,840 lbs.

The combined imports of flax and tow into the United Kingdom for 1919 were 11,107 tons, and for 1920, 20,888. Their respective values were £2,776,858 and £7,778,674. These figures show an increase in quantity amounting to 9,781 tons, and an increased value of £5,001,816.

The Report abounds with tabulated detailed particulars of the relative values of flax from different countries; of exports and imports from and to each country; of the distribution of imports into the U.K. over a number of years; of imports and exports of yarns from and to specified countries; of manufactured linen fabrics, both as regards quantity and value; and of numerous miscellaneous facts concerning flax, line and tow yarns, and woven linen fabrics in foreign countries.—F. B.

THE STATUS OF A DYER.

Mr. J. E. Brierley, President of the Foremen Dyers' Guild, gave an address on "The Status of the Dyer" before the West Riding Section of the Society of Dyers and Colourists, at Bradford, on Thursday, January 19th. Mr. H. Jennings presided.

Mr. Brierley, at the outset, made a plea for the British colour manufacturer. He said that in the experience of the practical dyer the charges frequently laid against the British colour manufacturer were unjustified. There was room for much improvement, but they were producing satisfactorily many colours which were required. Time, and above all encouragement, should be given to them. With regard to the dyeing industry, two things were essential—efficiency and economy; and a dyer's duty was to contribute his share towards that end. His position was not an enviable one, because of the difficulties with which he had to contend. A dyer had to be acquainted with colour and the method of its application; he had to be able to produce and reproduce at will a correct shade; he must produce that shade in a manner suitable to the use to which the cloth was to be put, and he had to carry out the process at a minimum of cost and time, and with a minimum of damage to the material itself. Theory did not always help them, because there were practical difficulties which were not met with by the scientist in his laboratory. Amongst these, he might mention irregularity in steam pressure, retention of dye in wooden cisterns, and lack of standardisation in colours. Great difficulty was caused by the previous treatment of the piece, and the success of the piece dyer depended largely upon the successful preparation of the piece. He submitted that a piece run through a dye bath in rope form could not possibly be listed through dyeing causes. In his opinion, the piece dyer should supervise the scouring and preparation of the pieces he had to dye. The old type of dyer was passing away, and a new and more intellectual type was coming into existence. The technical schools had to be thanked for a great deal, because they had produced a scientific mind which gave more satisfactory results when brought in practical contact with dyeing. The dyer of to-day must acquaint himself with the science of dyeing and have a thorough knowledge of colouring matters and their varying methods of application. The best dyer was he who could produce any required shade with as few colouring matters as possible. A dyer who had to look to the colour-maker for a mixture which would produce the required shade was not a dyer at all. The dyer was of vital importance to the industry, and he had to perform a duty of high skill. He pleaded that the coming of the higher type of dyer should be recognised, and that, in order to keep in the industry the more intellectual and responsible men, adequate compensation should be made for services rendered.

Mr. H. Sutcliffe Smith said that having been through the same troubles himself, he could sympathise with Mr. Brierley in much that he had to say. When he was a youth he had had a practical experience of a dyer of the old school, who had mixed together about nine colours which successfully neutralised each other. He was eventually replaced by another dyer, who employed three colours only, and it was forcibly brought home to him that the first dyer had been wasting thousands of pounds worth of dyes every year, whilst the second dyer got much better and clearer shades. He had seen that money could be saved by employing the very best and cleverest dyers.

Mr. W. P. Walker said the war had possibly helped to establish the status of the dyer. When the war broke out they were deprived of a large number of dyestuffs, and dyers had to work with fewer materials. Consequently, they were compelled to gain a greater insight into the working properties of the available dyes.

Mr. D. McClellan recalled that Lord Moulton had urged the dyeing industry to get back to the primary colours, and had suggested that the colour makers had made them lazy by producing colours for each required shade.

Mr. F. Smith said it would be feasible to use three primary colours if they possessed three dyes which would stand equally every possible influence they might be exposed to. Different customers however, had different requirements, and some dyes could not be used on mixed wools.

Mr. Brierley said he agreed that they could not do everything with three primary colours, but a large number of combinations could be obtained, and a limitation of the number was a step in the right direction. What they required were three primary colours, all equally fast, and capable of being dyed together. —M.

TECHNOLOGY OF TEXTILE DESIGN.

Lecturing at Bradford Technical College on the 20th January, Mr. A. E. G. Brookes (Manchester) said the technology of design was primarily concerned with the texture or "weave." Texture was the dominant quality of textiles from the technological standpoint. Colour was sometimes of more importance than ornament, especially in fabrics of more or less simple cloth structure, such as shirtings, ginghams, linings, dress goods, suitings, &c. In the matter of terminology in regard to textiles, the lecturer said it was deplorable that a great trade like the textile trade should allow the position to be so unsatisfactory. A large number of "trade" descriptions of fabrics were misleading, whilst drapery stores often submitted descriptions which had little or no connection with the cloth described. Fortunately, we had almost recovered from the shock of many styles, designs, and colourings which gained favour in the war period—productions which would not have been tolerated in normal times. The inevitable reaction was taking place, many of the weird designs which doubtless emanated from the Russian ballet—jazz and Slav inventions—were losing their vogue, and we might now look forward to productions which would give distinction and dignity to British textiles the texture qualities of which were unrivalled.

LEEDS UNIVERSITY AND TEXTILE INDUSTRIES.

In their report to the Worshipful Company of Clothworkers for the session 1920-21, the Advisory Committee of the Departments of Textile Industries, Colour Chemistry and Dyeing, and Art, of the Leeds University, express gratitude on account of the generous decision of the Clothworkers' Company to increase by £1,000 their grant for 1921-22 towards the maintenance of their departments. The report states that this additional contribution facilitates a necessary review of the staff salaries and lessens the Committee's anxiety as to finance. The new laboratory in the Colour Chemistry Department has proved of great value and admitted a larger number of students. Regarding the Department of Textile Industries, it is reported that a beginning has been made in the development of research along physico-chemical lines by the appointment of Mr. E. A. Fisher as Research Assistant. A comprehensive scheme of research has been drawn up and considerable progress made. A special method of yarn testing has been worked out in the department whereby yarn strength is expressed in terms of fibre strength and this has resulted in a much deeper insight into the spinning efficiencies of fibres than was formerly possible. The 1920-21 session of the Department of Colour Chemistry and Dyeing has been the busiest yet experienced. The vacancy caused by the resignation of Dr. Oesch has been filled by the full-time appointment of Dr. Forster.

INTERNATIONAL EXCHANGES.

Addressing a meeting of the British Association of Managers of Textile Works, at Manchester, on the 20th January, on the above subject, Mr. E. T. Parkes (Oldham) said that bankers, Ministers, Members of Parliament, business men, mill managers, labour leaders, and even working men in discussing the question of foreign exchange nearly all ascribed a great part of our present trade depression to the bad state of the exchanges. The widely prevailing misconception that it is the state of the exchange which produces bad trade should be cast out of the way. The exchanges are the result of trade dislocation and not primarily the cause. Bad exchanges make trading difficult, but the bad exchange is itself but the expression of other factors which have disturbed the normal course of trade, and, therefore, if we want to trace the evil to its source we must look behind the exchanges and see what it is that causes them to fluctuate. Probably the greatest lesson we have had to learn in the post-war period is the one of the solidarity of the human race. No one suffers without others being affected also—the innocent with the guilty. The best thing we can do now is to all take a hand in the regeneration of the happiness and well-being of the world.

REVIEWS

THE DECORTICATION OF FIBROUS PLANTS. By H. R. Carter. (J. Bale, Sons, and Danielsson, Ltd., London.) 79 pages. Paper covers.

The reprint of this handbook deals in a general way with the separation of flax, hemp, jute, and ramie fibres from the woody or pulpy material with which they are naturally associated as they come from the field or plantation. Some consideration is given to the various methods adopted in harvesting hemp (including Manilla, New Zealand, and Sisal), jute, ramie, and flax. The varieties of retting processes and the preparation for them are also described for each of the above classes of fibre, including a few of the mechanical decorticating machines for Sisal hemp and hard fibre materials.

A considerable portion of the book is devoted to an enumeration of the existing systems of retting flax in ponds, rivers, and warm water tanks, and by the Rossi and chemical processes. A few pages are also devoted to the process of scutching flax.

The 79 pages are not divided into chapters or otherwise systematically arranged for reference. The same subject matter is intermittently dealt with in different parts of the text. A careful reader who knows something of the processes of which it treats will find some interesting and useful technical points. The book is illustrated, chiefly with machine makers' perspective views, but without adequate descriptions. —F. B.

" TEXTILE MANUFACTURER " YEAR BOOK (1922). Emmott and Company, Ltd., 65, King Street, Manchester. Price, 3/6.

This annual publication retains its individuality, and provides an abundance of features specially helpful from the point of view of useful reference. Cotton is dealt with from growth to the final stages in manufacture, and at all the stages references are provided. Of particular interest, perhaps, is the record of weaving faults (by L. J. Mills). Wool and the woollen and worsted industries are dealt with as to important detail, whilst problems common to the textile industries are referred to in concise manner, the contribution on " Patents," for instance, being typical of the subjects of more or less common interest upon which definite information is available. Factory regulations are also dealt with. A directory of textile employers' and other associations is given, whilst a page-to-a-week diary is provided at the end of the book. Where price is a consideration, the book should make a strong appeal.

BLEACHING AND RELATED PROCESSES, AS APPLIED TO TEXTILE FIBRES AND OTHER MATERIALS. By J. Merritt Matthews; pp.676. New York: Chemical Catalog Co., 1921. (Price $8.)

This book forms the most complete treatment of the subject which has yet appeared. One is impressed with the immense amount of work which the compilation has entailed, and the author has treated the subject with an even greater thoroughness than he used in his previous technical publications. The work is divided into 32 chapters, dealing with :—Introduction; wool fibre; scouring of wool; bleaching of wool; boiling off of silk; bleaching of silk; boiling out of cotton; bleaching of cotton; faults in cotton bleaching; bleaching of linen and other vegetable fibres; stripping of dyed materials; and materials used in bleaching. There is a good bibliography. Since the book is such a good one, one hesitates in approaching it critically, but the remarks given below are intended to be helpful; they are given in the spirit of seeking to improve the second edition which it is hoped will soon be called for.

It is difficult to write a text-book for students, textile chemists and bleachworks workers, because these groups contain a variety of intellects, and this the author realises. He, therefore, concentrates on one group, namely, the last mentioned, and avoids in the text too many chemical formula. He finds this attitude difficult to maintain, however, and lapses at times into discussions of chemical theory such as the chemical composition of hypochlorite solutions. It is here suggested that the author cuts out his apology for such lapses because it is manifest to those in the industry that such discussions will benefit the industry. The preparation of the book has evidently taken a long time, and it is noticed that recent research work has not received the attention that earlier work has obtained. Perhaps the author found it difficult to be continually adding references to new work, particularly as this work meant, in some cases, the re-casting of his chapters. A new edition will perhaps get rid of this criticism. A special point is made of the fact that no revolutionary changes have been made in the bleaching industry during the last hundred years, and this is substantially true, but is it not the greatest compliment we can pay to our predecessors in the industry? The process described by Parkes in 1823 is the basis of the process now used, but during the period 1770—1820 great headway had been made, particularly in England. The author states that in America progress had been made from the lime boil to the caustic soda boil, but is that progress? Is it not a fact that caustic potash and caustic soda were used in impure forms from the earliest times, and did not lime boiling only gradually gain a footing, in spite of the prejudice against it because it was said to be a cheaper bleach? The development of chemical industry and the production of cheap caustic soda by the Leblanc process made it possible to use caustic soda for scouring, but this was primarily a return to the old state of affairs because of the change in economic conditions. Moreover, the statement of the general adoption of caustic soda scouring in America does not apply generally in the industry. The author presses the point that bleaching is a great industry *in esse* and a scientific industry *in posse,* but it is questionable whether the distinction is so marked as he makes out. Although big changes on the chemical side have not taken place during the period mentioned, gradual but distinct progress has been made. During the whole period, innumerable trials on the large scale have been made, although the results of these trials have not always been published, but the results have led to the adoption of methods which chemists find to be sound. Further progress is wrapped up in the investigation of the constituents of raw vegetable fibres. The bleacher's duty is generally to separate the cellulose of the vegetable fibre from the other constituents, and he seeks to do this in the most economical manner with the least injury to the fibre. The vegetable fibres contain cellulose, pectic matter, proteins, colouring matters, mineral matters, &c., all of which constituents are of undetermined chemical composition, and it is because of this lack of knowledge of the constituents of the raw fibres that the chemical development of the industry is hindered; until we know much more about these bodies we cannot expect very much help from pure science, and progress in the industry will be derived from trials which are variously called " hit or miss," " rule of thumb," or " empirical."

The position is very clear. Changes in the methods of bleaching will depend on advances in plant physiology and in bio-chemistry: it is for this reason that co-operative research in the cotton industry is so pressing.

Considering the book in detail, the author can hardly justify the use of most of the matter in the Introduction; the bit of history is poor, although there are historical notes of importance in the body of the book. Any matter of importance in the Introduction overlaps other matter given later, and this first chapter should be remodelled or cut out. The mixing up of animal fibres and vegetable fibres in one treatise cannot be justified as, on the author's own admission, the word " bleaching " connotes the bleaching of vegetable fibres. The treatments in the two cases are so entirely different, and interest distinct classes of technologists, that the author would do well to consider issuing subsequent editions in two distinct parts. The solvent extraction process for wool is given thoroughly and can be commended to wool scourers in England, where, hitherto, the process has not made headway because of the supposed detrimental effect of the process on the wool fibre. It is pointed out, however, that not only is wool scoured in this way better than by the old process, but more cloth is obtained from the wool after solvent extraction. Moreover, the sale of the wool fat extracted covers all the costs of the process.

The modern method of machine bleaching for cotton cloth is referred to by the author as the "American Process," but should it not be called the " Bolton Process?" Thomas Ridgway built Wallsuches Bleachworks, Horwich, Bolton, in order to apply the chlorine method of bleaching. He made his own bleaching liquor, which was then called "chemical"—hence the word "chemic," and not "chemick," as used by some writers. With the lead given by Ridgway, great progress in the methods of bleaching and finishing were made in the Bolton district, and when the chemical side was improved the mechanical side received consideration. As regards machine bleaching, the following extract from the diary of T. R. Bridson (the younger), January 21st, 1846, is of interest:—"I saw this day Jno. Brooks' new plan of bleaching at Sunnyside by the *continuous* process. The cloth is first stitched together piece by piece to the extent of any number of pieces and then passed over rollers into a washing machine where it receives a number of revolutions in the water and proceeds without interruption over another roller into the stewing kier. It is laid in there with the assistance of a couple of boys who merely keep the cloth from being too much in one place and act pretty much like lads on the top of a hayrick. After stewing the usual time it is washed as before, and goes through the various operations of boiling, chemicing, and souring (with washing between each) squeezing, putting up, drying on tins and plaiting off without the first arrangement of the cloth in continuous line ever having been disturbed. It is quite impossible to estimate the saving of labour by this plan." Previously, the dash wheel had always been used for washing.

Little points worthy of notes in the book are the questionable figures given on page 195 for the analysis of the cotton fibre, the lack of discussion in a full manner of a number of researches on the effect of the bleaching process on the strength of cotton yarns, the distinction placed on the fats and waxes of the cotton fibre, whereas these are generally considered together, and the spelling of Javelle on p.301 and of Jakowkin on p.304. The chapter on linen bleaching is well done considering the published material available; but little has been published to indicate modern methods in the industry. The inclusion of the treatment of these special fibres in the book can only be justified on the grounds stated by the author—that he wants Americans to become interested in them. The author cannot be expected to have a sound practical knowledge of all branches of the industry, and after finding the bleaching of cotton done so thoroughly it is disappointing to notice flax bleaching treated in the manner of a popular encyclopædia. The author's method of dissolving bleaching powder is interesting, and it is worthy of note that, after considering all the evidence, he supports the view that the bleaching action of hypochlorite solutions depends on the hypochlorous acid present in the solution. One notices a number of statements in the text which are open to question, but this state of affairs is inevitable. The author gives the whole of his experience and does not leave the feeling that he has withheld any important matter from his practical experience. —S. H. HIGGINS.

REPORTS ON JUTE AND SILK. Imperial Institute: Indian Trade Enquiry. John Murray, London. Price 5s.; pp.90.

In 1916, the Secretary of State for India invited the Imperial Institute Committee to conduct an enquiry into the possibilities of further usage of Indian raw materials in the United Kingdom. Special committees were formed to deal with different materials and the present publication embodies the reports of the committee on Jute and Silk.

Statistics regarding the cultivation, production, export, consumption, and manufactures of jute are furnished. The question of possible taxation of the raw material is dealt with at some length and a number of definite recommendations are made. These include an export duty on raw jute with a rebate of 100% to consumers within the Empire, the income to be devoted to investigations dealing with jute and allied fibres. It is suggested that when seed selection experiments are sufficiently advanced the Government of India should provide the grower with seed and ensure the use only of approved seed. Certain legislative measures in regard to the marketing of the crop are suggested. There are eight appendices of statistical tables relating to the jute industry and trade, a summary of evidence of witnesses, and a copy of a report of the Committee of the Indian Jute Mills Association on the subject of trade after the war dated September 29th, 1917.

The report on Silk deals, in a somewhat similar manner to that on Jute, with the Silk industry in India. The chief recommendations are classified under the headings :—Economic and Industrial questions and Sericultural questions. Under the former heading, it is held that the development of the silk industry in India is dependent on Government support and European supervision. In this way only can the Indian silk industry increase the production of good quality raw silk and meet the increasing competition of Japan and the Far East. Specific measures for the improvement of the quality of the silk are outlined. Under the second heading, the establishment of a Central Government Seriological Institute is recommended. The functions of this would include the training of men, the supply of disease-free eggs of approved native and foreign races of silkworms, hybridisation work, the investigation of the diseases of silkworms and of the mulberry and the study of modern reeling processes. To this report there are six appendices of statistics and a lengthy summary of general information on the Silk Trade of the World prepared at the Imperial Institute.

The publication is well printed, is written in an attractive form, and should be of considerable interest and use to those concerned in the Jute and Silk industries.

—W. R.

COTTON SPINNING MACHINERY AND ITS USES. By Wm. Scott Taggart. Pitman's Technical Primers. Sir Isaac Pitman & Sons, Ltd. (2/6 net.)

This little work is based to some extent on the suggestions made by the Board of Education Memorandum on the Teaching of Textiles. Thus, the elements of cotton spinning processes are first taken, irrespective of the sequence of the actual machines. One important result of this scheme is that more consideration is given to the effects produced on the cotton than has usually been the case in books on cotton spinning; another is that the beginner is presented with a general view of the fundamentals of spinning, instead of receiving a bewildering mass of detailed information about the preliminary processes before he knows anything of the subsequent machines. In short, this section of the book is a sound introduction to the study of the technique of cotton spinning. In later chapters, the machines are described individually, and the author's difficulty here appears to have been in deciding what to include and what to leave out.

There are over ninety excellent drawings, many of them specially made to emphasise the treatment to which the cotton is subjected, and there is a final chapter of practical notes. —W. E.

THE "TEXTILE RECORDER" YEAR BOOK, 1922. Compiled and Edited by Frank Nasmith. (John Heywood, Ltd., Manchester and London); 7/6 net, 662 pages.

Briefly, this first treatise may be called an encyclopædia of textile raw materials, yarns, and fabrics, since it abounds with condensed information on the chief characteristics of these articles. The manipulation of cotton, flax, jute, hemp, and ramie, of the vegetable fibres, into their respective varieties of yarns is most effectively dealt with; including the marketing, preparation, classification, carding, combing, drawing, spinning, doubling, twisting, and sizing of the different counts of yarns. The animal fibres—wool, silk, and silk waste—have also received due consideration. The preparing (gilling and carding), drawing and spinning of worsted yarns by the English and French systems, and the carding and spinning of woollen yarns are reasonably dealt with, as are also the different systems of preparing fancy twist yarns.

The section on silk, both natural and artificial, is well arranged and informative, and of special interest as both yarns are extensively used in combination with other textile yarns, irrespective of their exclusive use in the manufacture of all silk textures.

The manufacture of the various kinds of woven fabrics, including weaving and its preparatory processes, and the subsequent operations of dyeing, bleaching, and finishing are adequately dealt with.

A very interesting and valuable feature of the book is a glossary giving details of the manufacture of practically all the standard woven cotton, worsted, woollen, silk, linen, jute, and minor textile fabrics.

The section on hosiery trade and manufacture contains much useful information —general, practical, and technical.

The fundaments of textile design and the uses and sizes of the various kinds of point paper are dealt with, and a few standard structural designs are given. The application and development of figure designs in woven textures are adequately though not minutely treated.

Some consideration is given in the concluding pages to fuel consumption, and steam and electric power, including much tabulated data and comparisons. Several pages are devoted to the application of electricity to textile machinery, both for individual and group driving. Much useful information is supplied on rope, chain, and belt driving and mill gearing.

A few pages are included on the important subject of humidity and temperature in spinning mills, and many pages on miscellaneous textile subjects.

Many useful calculations and tables are supplied for each class of material included in the book. The inclusion of rates of wages at a time when this subject is subject to considerable fluctuation may be open to question, but the information is valuable if only from a historical point of view.

The book is the product of many minds, the editor having called to his aid 23 special contributors. It is well printed and bound, and is of exceptional value to all interested in its contents. —F. B.

AN INTRODUCTION TO JUTE WEAVING. By Thomas Woodhouse and James Ireland. (William Kidd & Sons, Whitehall Street, Dundee; 136pp.; Price note stated.)

Specially compiled with a view to the provision of a really useful text-book for students preparing for examinations in jute weaving, this handy book seems likely to fulfil its purpose admirably. Beginning with a general description of the methods of counting yarns, the authors proceed to deal with the winding of warp and weft yarns and other preliminary operations. Warping calculations form a lengthy chapter, and many points arising are treated in the form of question and answer. Indeed, in the book, about one hundred questions from the jute section of the City and Guilds of London Technical Institute's examination papers are submitted and answers provided, whilst comment is added in many instances by way of further elucidation. After dealing with the preparation of grey jute warps—starching or dressing—weft winding, &c., the book concludes with detailed descriptions of typical jute fabrics, with warp and weft calculations. The reading matter throughout is concise, and considerable care has evidently been taken to keep the maintainence of clarity before all other considerations. —A.

THE JOURNAL OF THE

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PROCEEDINGS

YORKSHIRE SECTION

Meeting at Bradford, 1st December, 1921, Mr. John F. White in the Chair.

TELEPHONE SERVICE EFFICIENCY

By Brevet Lieut.-Colonel W. A. J. O'Meara, C.M.G.

In this paper, the author, who gave evidence before the Select Committee of the House of Commons to inquire into the telephone service of the country, reviewed the evidence given before that Committee, and traversed the evidence contained in the "Report from the Select Committee on the Telephone Service" (H.C.191 of Session 1921) with a view to securing information as to the standard of reference by which telephone service efficiency might be measured. The evidence, the lecturer stated, did bring out, to some extent, the conclusion that the first requirement for the promotion of efficiency in the telephone service relates to matters which lie wholly in the domain of the engineer. Neither skilful operating nor clever management can ever overcome shortcomings on the engineering side. Moreover, the records of investment and earnings per telephone are not *per se* either adequate or suitable standards by which to compare telephone service efficiencies in the different quarters of the globe. A clear understanding of the meaning to be attached to the term "telephone service efficiency" is desirable. Briefly, then: A telephone service must completely meet the needs of the whole community without showing favour to any section thereof; it must be the most perfect of its kind, furnished at rates which are reasonable when judged by the particular conditions to be met, and framed upon a tariff scheme which is equitable by reason of its being suited to meet the legitimate requirements of the would-be users of every class in the community; it must be economically conducted and skilfully managed.

Having submitted the foregoing definition, the author proceeded to deal with cost of providing telephone services under the three main heads of engineering expenditure, operating costs, and administration costs. As regards the effect of development on costs, the Departmental Committee in this country takes up an attitude which amounts practically to this : it admits that with development economies in plant construction follow, but says whatever savings there may be on the engineering costs they are all neutralised by the extra cost entailed in operating a system as the density of the telephone users in a locality increases. It argues, therefore, that there is no net reduction in costs as development proceeds. Inquiry, however, does not confirm these views of the Departmental Committee. The Swedish Telegraph Administration has for years published a most valuable annual report containing highly important statistical data in relation to the telephone services under its care. The figures therein presented show clearly and definitely that traffic costs per subscriber's line are in no way connected by a law with the number and density of telephone users in the exchange area. The figures prove that factors other than the number of lines terminated in an exchange often tend to increase operating costs, and, consequently, the very small exchanges are as a rule as costly to operate per line as the largest exchanges; and, further, that as telephonists' wage rates rise the cost of operating the larger exchanges increases in a higher ratio than is the case in the small exchanges. It is thought that an examination of operating costs, in detail, of the 2,909 P.O. exchanges under postmasters, as is done in the case of the small exchanges in Sweden, would disclose the fact that in this country also many of the very small exchanges are quite as costly to operate per line as the large exchanges in London, and that the larger exchanges in the provinces are less costly to operate than those in the Metropolis—not because fewer operators are required, but because the wage rate for telephonists is lower in the provinces. Nevertheless, the tendency of late has been for operating costs to rise, owing to the higher payment to the woman worker. Development, in the sense of technical progress, has pointed to the remedy, however, and it lies in a more extended use of machine switching equipments, either in the form of semi-automatic or full-automatic installations. Automatic types of equipment represent no new invention, for this type of equipment was first brought into use in the U.S.A. more than 20 years ago. Considerable progress in the use of this type has been made on the continent of Europe, particularly in Holland and Bavaria, and many important cities and towns were provided with this type in pre-war days—Munich, Dresden, Posen, Amsterdam, etc. Development in the case of a telephone undertaking should affect administration costs in a way similar to that produced by expansion of an industrial business. The ratio of administration costs to total costs should be a decreasing figure, the extent of the decrease depending upon the organisation and methods of administration pursued.

Being an engineering enterprise, the telephone undertaking should be endowed with an engineering organisation. In the days of the National Telephone Company an engineering organisation existed, but with the transfer to the State the old organisation was scrapped and the telephone service was somehow squeezed into the hybrid organisation of the G.P.O. That things have not worked out well is not to be wondered at. How anybody can expect to get efficient management where an organisation is provided to run three enterprises with such diverse characteristics as the P.O. Savings Bank, Posts and Telegraphs, and Telephone under the directive control of a single permanent head passes comprehension—an organisation, too, which requires a Secretary's Department with an establishment of 940 officials of all ranks, an Accountant General Department with a headquarters establishment alone of 2,585 individuals, and in which the Chief Technical Officer is outside the central organisation and has a status of the fourth or fifth grade instead of being one of the principal and most important officers in the organisation.

After dealing with the matter of standards of efficiency, the lecturer discussed the question of tariffs, and said that the fact which stands out clearly is that, generally, in foreign countries, the rates have been framed on the principle of the value of the service to the subscriber and not on the actual cost basis which so much took the fancy of the Departmental Committee on Telephone Rates; further, that the measured rate system (the " message rate " in America) is the basis upon which subscribers pay.

In a lengthy conclusion, the lecturer said:—It is quite possible to establish a certain number of standards of reference for the comparison of telephone service efficiency. The question arises—Are there just grounds for the complaints that are rife in regard to our telephone service? Now, the extent to which a service is used by the public is often the most reliable test as to whether the service is provided on lines to meet public needs or not, and it is a test which has been held to be peculiarly appropriate in the case of a telephone service. The following figures, taken from Mr. Kingsbury's book on the Telephone, indicate the position at the time of the outbreak of the Great War:—

Telephone stations per 1,000 of population.

U.S.A.	97	Sweden	41	German Empire	21
Canada	65	Norway	34	Great Britain	17
New Zealand	46	Australia	28	Netherlands	14
Denmark	45	Switzerland	25		

According to the above figures, the user of the telephones in the U.S.A. before the war was five times as great as in Great Britain, and in Norway twice as great. Since the war there has been an increase in the number of telephones per 1,000 of population, and in England the figure is now 22, *i.e.*, there are now 5½ times as many telephone users per 1,000 of population in the U.S.A.

The foregoing figures clearly indicate that there are causes militating against an extensive use of telephones in this country. What are they? The evidence given before the Select Committee on the Telephone Service shows that important sections of the community have not been able to avail themselves of the service, not because any favours have been, or are being, conferred upon a particular class, but because of the costliness of the service and of the narrow lines upon which the general policy of the General Post Office is framed and run.

One of the official witnesses informed the Select Committee that the automatic equipment had " proved in," as the Americans say, and, in consequence, the introduction of this type of equipment would tend not only to bring about improvement of service from the technical standpoint but would also reduce costs. But, in view of the knowledge it possesses, how is our telephone administration shaping its policy? When the Leeds Automatic Exchange was opened some time ago by the Postmaster-General, it was reported in the newspapers that the Chief Technical Officer of the Post Office, in the course of a speech extolling the system, added: " But if you want it you must agitate for it "! What would be thought of such a statement from the management of a private undertaking owning a monopolistic business?

What are the remedies to correct the various matters which have come under criticism so far as our telephone service is concerned? President Taft, 17th January, 1912, submitting to Congress the report of his Commission on Economy and Efficiency in the Government Service, stated: " Only by grouping services according to their character can substantial progress be made in eliminating duplication of work and plant and proper working relation be established between services engaged in similar activities. Until the head of a department is called upon to deal exclusively with matters falling in but one or very few distinctive fields, effective supervision and control is impossible."

Here we have the key to the initial reforms required in the organisation of the G.P.O. A complete separation should be made of the services which are largely administrative in character from those that are largely technical, and each should be endowed with an organisation, a system of administration, and a staff suited to its own individual needs. The Telegraphs and Telephones should be run in combination. It is imperative that a higher standard of qualifications should be exacted in the technical staff, and this must necessarily be accompanied by a very considerable improvement in the status of the officers employed in the technical branch of the service in order that suitably qualified men of a professional stamp may be attracted into the public service. It is by reforms of a very drastic order alone that it will be possible to provide telephone services in this country of the quality that telephone users have a right to expect, and that the needs of every section of the community will receive proper consideration and be adequately met. The Minister who has the courage to re-model the organisation of the General Post Office in order to enable it efficiently to meet its present-day obligations would be taking the most essential step requisite to promote telephone service efficiency in this country, and by achieving his purpose he would earn the sincere gratitude of the business community of these islands.

SOUTH OF SCOTLAND SECTION

Meeting at Galashiels, 16th December, 1921, Mr. John Hutcheson in the Chair.

SCOURING AND MILLING

By J. SCHOFIELD, B.Sc., A.R.C.Sc.

It is possible to classify the various methods of textile scouring in more than one way. On the wool side of the textile industry, piece scouring might be divided, according to the materials worked on, as :—(1) Scouring of high-grade woollens; (2) scouring of worsteds; (3) scouring of low-grade goods. These differ primarily in respect of the kind and quantity of oiling applied to the fabrics. Thus on the better class woollens there would be heavy oiling of, say 10% on the weight of the wool, and consisting of good quality wool lubricant containing in general much free fatty acid. Contrasted with these are the good quality worsted cloths carrying light oiling of 2—3%, and of a neutral or nearly neutral type. In the low-grade goods, the oilings are again heavy and of a worse type, often with large percentages of mineral oil; here, also, there are the special difficulties of these fabrics to be detailed later.

SCOURING METHODS.

(1) Solvent scouring, in which oily and fatty matters are extracted from the fibre by the direct solvent action of benzene, petrol, &c.

(2) Saponification scouring, in which the free fatty acids of the oils are converted into soaps in the scouring machine by the action of the alkali.

(3) Emulsification scouring, in which the greasy dirt is removed mechanically by the formation of a frothy lather or emulsion; the wetting-out power of this lather causes the breaking up and detachment of the oil, &c., from the surface of the wool fibre. This is obviously a physical process as contrasted with the chemical process of scouring by saponification.

These methods are ideal statements of types of scouring to which practical methods conform more or less. Thus, most scouring of raw wool in the usual bowls is of the emulsification type. The scouring of fancy worsteds by weak alkali and some soap is a further example of emulsification working.

On the other hand, good woollens carrying oil with large percentages of free fatty acids may be scoured throughout—and well scoured—by alkali alone; sufficient soap is formed in the machine to use up the oiling both directly as soap and indirectly as emulsion. This is a typical saponification scour. The scouring of low-grade goods has usually to be of a composite kind which we shall consider later.

It is most useful to discuss first the saponification scour, as it well illustrates the principles concerned, is scientifically justifiable at all stages, is easy to carry out in practice, and, finally, is thoroughly efficient in its results. It is completely described on p.120 *et seq.* of my book on "Scouring and Milling" as a standard scour on heavily oiled woollens. It is an obvious truism that the oiling for wool lubrication at the spinning end and the subsequent scouring operations must be intimately connected. In the present case of good woollens it is assumed that the spinning oils are the usual "Oleins"—*i.e.,* crude oleic acid of high saponifiable quality with some mineral oil, say, 20%—commonly employed in the trade. In this case, the wool oils will have large amounts—possibly 40 to 60% or even more—of free fatty acids; that is, these fatty acids will not be combined, as in the neutral animal and vegetable oils, with glycerine, but are free to enter into chemical union with the soda carbonate to form soap. This is a reaction which is possible at moderate temperatures and hence the scouring of such goods is quite practical by alkali alone as follows:—

Stage 1.—Run in soda ash solution of 5—6 Tw. at about 90° Fah., using, say, 20 gallons per 100 lbs. of wool. Let this saponify, running for ten minutes or so, and then without addition of water open the sud box and let the dirty emulsion away to the drain. When the machine is thus emptied:—

Stage 2.—Add alkali as before, about five gallons per 100 lbs. of wool, scour for twenty minutes or so, and:—

Stage 3.—Wash down; warm water at first, and slowly, then stronger and colder.

The principles of this saponification two-stage scour are:—

(1) Attack by alkali on the free fatty acids of the spinning lubricants with formation of soap.

(2) The resulting emulsification detaches the superficial dirt of the fibre, and this is removed at an early stage from the machine.

(3) This stripping action is intensely assisted by the generation *in situ* of carbonic acid gas by the action of the fatty acids on the alkali in forming soap—an extremely powerful detergent factor peculiar to saponification as contrasted with purely emulsification scouring.

(4) The use of a clean and unexhausted scour, of good diffusibility, for the deeper penetrated dirt of the fibre, which requires longer continued action for its

saponification and emulsification. It must be remembered that colloids do not diffuse through colloids; soap as soap is not a penetrant of the wool fibre. But a crystalloid substance like soda carbonate possesses high diffusibility and can pass into the actual tissue. The method here described is probably the most efficient of all scours on wool goods in point of cleanliness in the resulting fabric. Seeing that much of the free fatty acid of the wool oil is oleic acid, the resulting soap formed in the machine is a Sodium Oleate. Such soaps are known to be particularly soluble at comparatively low temperatures, hence their scouring properties are enhanced, and, further, their easy removal from the fabric is assured. It is instructive to consider this scour as an ideal to be followed as far as practicable in other cases.

Consider now the scouring of high class worsteds. Here, the oiling is not only much lessened in quantity but is usually of a more neutral character. Now the saponification of a neutral oil, even when of animal or vegetable origin, cannot be effected by carbonated alkalies at ordinary scouring temperatures. Hence, a straightforward saponification scour is not feasible on these goods, and the usual process is as follows :—

Fancy Worsteds Scour.—Alkali of 2—4 Tw., in accordance with the reduced oiling, together with some soap from the outset, the idea being to work up an emulsion which, by diminished surface tension or increased wetting-out capacity, will detach the oil and dirt and float them away from the fabric.

It would be interesting to know the practical reasons, if any exist, why worsted spinners do not use oils with large fatty acid content as do their brethren on the woollen side. The addition of small amounts of free fatty acid to mineral oil for machine lubricants has been found to increase their efficiency, diminishing the friction in some cases to one-half that of mineral oil alone. In the textile case, the presence of free fatty acids enormously facilitates the work of the scourer, and it is therefore important to know what are the objections on the worsted side. It is, however, an actual fact that many worsted " oleines " contain moderate percentages of such acids. In these cases, it is possible, and often superior in practice, to conduct a worsted scour thus :—

(1) Run on alkali 2—4 Tw., warm, for ten minutes, and then, without any addition of water, lead this off to the drain.
(2) Add more alkali—preferably weaker—and some soap, and complete the scour.
(3) Wash off, warm and gently at first, colder later.

It must be noted that over-strong alkali solutions prevent the proper solution of the soap; it is far preferable to work with weaker solutions and in more than one stage.

The "Low-goods" Scour.—In this class of trade, the unfortunate scourer meets with all his difficulties in their worst forms. There may be excessive bleeding of colour due to lose dyeings, poor dyestuffs, dyeing in the grease, &c., low-grade oilings often with much mineral oil, sizings, recovered wools, flock wastage, and the rest. In many cases, the conditions to be met are incompatible, *e.g.*, the necessity of scouring at low temperatures to prevent bleeding, thus losing the advantage of the decreased surface tension (*i.e.*, enhanced wetting-out power) of a warm scour.

The surface tensions of water at various temperatures are given in a paper in Science Abstracts, Oct., 1921 :—

Temperature, °C.	0	18	36	69	89
Surface Tension	76.7	75.6	70	64.8	60.9

Thus, taking 36°C. or 97°F. as a scouring temperature, there would be a gain of nearly 10% in lowered surface tension as compared with ice-cold water. Perhaps, however, the bleeding of colour must be prevented even at the expense of some perfection in the scour.

The low grade oilings offer in these goods the maximum of difficulty. There is often much mineral oil which tends to prevent the formation of proper emulsions, and, being itself unsaponifiable, is removable only by a process of emulsification. There is usually an undue proportion of other unsaponifiable matter and a correspond ing lack of free fatty acids; a sufficiency of these would in many cases simplify the scouring of the goods, enabling at any rate the first stage of a saponification scour to be effected. Many so-called " black oils " are excellent from the scourer's point of view owing to their high content of free fatty acids; much of the scouring of low-grade goods would be vastly improved by a judicious addition of suitable black oil to the spinning lubricant. It is undoubtedly desirable that wool oils should be specified in terms of free fatty acid, in addition to—or in place of—total saponifiable matter. It is free fatty acid and not merely neutral saponifiable oil which is of primary importance at the scouring end.

It is, therefore, not possible at present to lay down the exact lines of a low-goods scouring operation. If the oiling can be modified in the direction of securing a proper quantum of free fatty acids, then a two-stage scour of the following type may be practised :—

(1) Run in warm alkali 5—6 Tw. if the colours do not bleed; otherwise, cold. Scour for 10—15 minutes, and, without added water, open the sud box and pass this away to the drain.
(2) Add further alkali, weakened, together with some soap, to build up an emulsion; scour out.
(3) Wash down, preferably with warm water at first, if the dyeings will permit.

There are some special points in the practice of low-goods scouring which merit further discussion.

It is possible that slight additions of caustic soda to the first stage of the scour may be found useful. Caustic as against carbonated alkali will saponify free fatty acid in the cold; it is, further, more active in the softening of possible hardness in the water. But the concentration of such caustic alkali must be small in view of its strong tendering action on the wool fibre; a strength of perhaps not more than two ounces in ten gallons of the scour may be tried. Further experiments are necessary. Amonnia in scouring is invariably used in the form of hydrate and never as carbonated alkali.

Another question bearing on the low-grade scour more particularly is the use of the so-called " Solvents." There are a number of substances capable of dissolving oil or grease quite freely, *e.g.*, Ether, Chloroform, Carbon Bisulphide and Tetrachloride, Alcohol, Benzine, Petrol, Turpentine, and certain chlorinated hydrocarbons such as Trichlorethylene and Tetrachlorethane. When the various physical and chemical properties of these bodies are compared, it is seen that only a few, viz., Alcohol, Carbon, Tetrachloride, Tetrachlorethane, &c., are adapted for employment as adjuncts to a textile scour. And it further appears that their true utility is not the dissolving of oil or grease but their property of lowering the surface tension of the scour. If experiments by the drop pipette or by soap bubbles are conducted with solutions containing these bodies, it will be found that there is a reduction of the surface tension of the scouring liquor beyond that attained by the use of soap. Hence, there is scientific justification for their use under proper conditions, and further experience is necessary to determine which substance, and under what conditions, the highest efficiency is obtained. Other things being equal, the property of perfect miscibility with water possessed by a substance like alcohol is to be desired as against bodies like tetrachlorethane which require emulsifying agents such as sulphonated oils to assist their dissemination throughout the scouring liquor. The whole question is one requiring further investigation.

Some useful notions respecting the principles of scouring and the proper modes of procedure may be gained by considering certain extreme cases not necessarily met with in practice. Suppose fabrics lubricated as follows :—

(1) Oiled with pure mineral only.
(2) Oiled with pure neutral animal or vegetable oil only.
(3) Oiled with pure free fatty acids only.
(4) Lubricated with dilute glycerine.

Taking the last case first, a simple steeping and working in warm water would cleanse the fabric. The cloth oiled by free fatty acid could be completely scoured by the use of alkali alone. The fabrics having either mineral oil or neutral glycerides would require soapy emulsions, perhaps repeated several times; or, alternatively, extraction by solvents.

There are many other points in scouring theory worthy of close attention. The subject of detergent materials is in itself a wide one, embracing such questions as :—

(1) The proper strength of alkali solutions; and of soap solutions.
(2) The temperature of scouring.
(3) The best kinds of soaps for textile work.
(4) The function of ammonia in the scour, and its utility.
(5) The limits of mineral oil in wool lubrication; the penetration of such oils as compared with oleins, &c., into the fibre tissue.
(6) The use of Resin, Silicate of Soda, &c., in soaps.
(7) The limits of hardness of water for textile purposes.
(8) The consistency of the scour : should a scouring liquor be thick and creamy, or thin and sloppy?

DISCUSSION.

The CHAIRMAN, who had undertaken the reading of the paper in the unavoidable absence of the author, introduced a discussion in a most effective manner, calling upon Mr. D. K. Colledge to offer replies to questions submitted.

Messrs. GIBSON, GRIERSON, HAYWARD, Dr. OLIVER, and the CHAIRMAN raised questions and contributed to the discussion which turned mainly on the eight questions presented at the end of the paper.

The first point raised was as to the temperature of the scour. It was stated that when using oil such as Price's it could be scoured cold at a strength of 6 deg. Tw. This seemed to be the general opinion of the meeting, although Mr. Colledge pointed out that this was only possible when using an oil containing a large percentage of free fatty acid. He pointed out that, as the lecturer had already stated in his paper, the value of alkali as a scouring agent depended upon its ability to form a soap with free fatty acid, and obviously if the oil contained little or no fatty acid, as was commonly the case, then there was no value in using alkali.

The effect of scour on colours was also touched upon by one speaker who stated that the bleeding of colours noticed by him invariably took place in the milling and not in scouring.

After some discussion on this point, Mr. Colledge pointed out that anyone with an elementary knowledge of the properties of acid dyes would know that this was bound to take place because the effect of the scouring liquor would be to neutralise the acid in the fibre and would thus bring about the conditions under which the acid dyes would bleed.

The CHAIRMAN at this point very ably summed up the matter by stating that from the discussion it was evident that although bleeding did take place in the milling yet the cause of bleeding may be found in the scouring.

A question was then put to Mr. Colledge as follows :—" If two pieces received the same treatment in scouring and one was afterwards milled in the stocks and the second in the milling machine did he think on theoretical grounds the results should be the same? "

Mr. COLLEDGE replied that if the processes differed at all in any way he would never under any conditions imagine the results to be the same.

The relative advantages and disadvantages of Fuller's earth was then dealt with, two opposite views being held by different members about the effect of Fuller's earth in milling. The one view was that Fuller's earth gave a loftier handle to the goods than soap when used in milling and the other view was the direct opposite of this.

NOTES AND NOTICES

EXHIBITION OF YARNS AND FABRICS

As previously announced, this Institute is organising an exhibition of Yarns and Fabrics—to be opened at the Institute premises on the day of the Annual General Meeting, which has been fixed to take place on Tuesday, the 25th April. It has been decided to promote the exhibition for the reason that a similar event, held at the time of the World Cotton Congress at Manchester in June of last year, proved of quite exceptional interest. On that occasion the aim was to secure a collection of latest productions in yarns and fabrics, with particular reference to the cotton industry in which so many of the American visitors were specially interested. This year, it is hoped to cover an altogether wider field, and invitations have been issued to possible exhibitors in various branches of the textile industry. It is felt that it would be an enormous advantage if opportunity can be provided for representatives of the various branches of the industry to witness examples of most recent tendencies and developments in the respective branches. Members of the Institute are invited to offer suggestions as to possible exhibits, and, in this connection, it is important to note that available space is now being rapidly taken up. In the case of last year's exhibition, particular interest attached to new finishes, special designs, and developments in yarn production for particular requirements. In the matter of finishing, the announcement may now be made that a special exhibit this year will be presented in the form of a collection of grey cloths exhibiting faults from the point of view of the finisher. The examples will also show defects thereby created in the finished fabric. The whole problem of these faults will be discussed and further announcement will be made in this connection. At the moment, there is every prospect that the exhibition in April will prove of substantial interest and service to the industry generally. The exhibition will remain open from the 25th to the 29th April inclusive.

BRITISH COTTON INDUSTRY RESEARCH ASSOCIATION

The new research laboratories of this Association, at the Shirley Institute, Didsbury, near Manchester, are to be formally opened on the 28th of the present month by H.R.H. The Duke of York, K.G. The Shirley Institute is the name which has been given to the mansion formerly known as The Towers, and which was acquired by the Research Association. The residential premises have been converted into offices, library and other apartments, whilst the new laboratories have been erected in the grounds. The institution is being most thoroughly equipped, and the investigatory work of the staff is in the charge of the Director, Dr. A. W. Crossley. It is expected that the opening ceremony will be largely attended, as the membership of the Association embraces the bulk of the firms in the cotton industry. Mr. Kenneth Lee is Chairman of the Association, and, in view of the large number of invitations which have necessarily been issued, the wish will be general that fine weather may prevail for the ceremonial proceedings.

INDUSTRIAL CONCERNS AND "HOUSE" MAGAZINES

From time to time we have received copies of publications—nowadays familiarly known as "house" magazines or journals—from various firms associated with the textile industries. In one or two instances, attention has been directed to special features of activity denoted by the information recorded in these publications. It has been suggested that considerable mutual benefit might accrue from exchanges of copies of the publications in question on the part of the various firms who publish them, and it is believed that exchange is now more frequently practised than hitherto. We have received a copy of a recent issue of the "Northrop" Journal, issued in connection with the works of the British Northrop Loom Co., Ltd., which is particularly interesting in that a prominent feature is made of full and illustrated descriptions of products of the firm. The interest of the publication is thereby extended even beyond the limits of the circle of employes. Even within these limits, it may be highly useful to have all employes fully informed as to the firm's productions, more particularly in these days when employment is highly specialised and the employe has often to devote his whole attention and effort in one particular direction contributing to a given product.

TRANSPORTATION OF GOODS

In the years immediately preceding the war the volume of traffic passing over the lines of a railway company operating in an industrial area was regarded very much in the light of an index of the existing state of the principal industries of the area. That was in a time when the railways held, more or less, a monoply of the inter-town traffic, and it would be interesting to learn to what extent the introduction of a greatly developed and commercially organised system of road transportation of goods has affected the returns of the railway companies. At the annual meeting of the Lancashire & Yorkshire Railway Company recently, Mr. Edward B. Fielden, the Chairman, made an interesting comparison of the amounts of tonnage of merchandise, coal, and minerals carried by the Company in the years 1913 and 1921. In each case the comparison was unfavourable to the year just ended. The tonnage of merchandise was stated to be 4,739,663 as compared with 7,240,472 in 1913; coal, 10,781,349 as compared with 15,978,854; and minerals 2,110,119 as compared with 3,499,524. These figures show a reduction in volume of traffic of 9,087,719 tons, and the reduction represents a decrease in the total tonnage of 30.29 per cent. The decrease is formidable, and an analysis of the causes to which the decreases are attributable would prove instructive reading. That the slump in trade has been the most influential factor there may be little doubt, but it is evident that road transport has claimed a considerable amount of tonnage that would under pre-war conditions have fallen to the lot of this particular railway company. To re-capture the bulk of the short-distance traffic, the railway companies operating in industrial districts will have to offer greater rapidity in the handling of goods consigned, and, what is more important still, a reduction on the prevailing freightage rates.

CO-ORDINATING THE TEXTILE TRADE

The spirit and what may fairly be termed the driving force which the World Cotton Conference introduced into the trade, is being continued in an interesting fashion. Eventually, it will prove to be a profitable fashion also. It will be remembered that at the conference in Manchester a resolution was brought forward, the object of which was to bring about closer co-ordination between the manufacturing and finishing sides of the industry. This co-ordination was to operate in such a way that in any and every of the numerous processes of manufacture through which the cotton goes from the bale to the marketable article, more attention should be paid to the linking up of each process with the subsequent one. In other words, manufacturing and finishing were to be regarded as a whole, and not as water-tight compartments in which each section puzzled out its own difficulties. A paper which contributed no little to a sympathetic reception of the idea was one jointly presented by Mr. S. H. Higgins, of the Bleachers' Association, and Mr. Andrew Hodge, of the Calico Printers' Association. The paper dealt with the preparation of cloth for finishing, and showed how much manufacturers could contribute in their own work to the work of the finisher. Since the Conference, these two gentlemen have gathered a good deal of data of a practical kind. Co-ordination is a question for the industry itself to solve and bring into being, and the fact that something is being done, even in an unofficial manner, will all count when the matter comes to be discussed officially, as it must be. The cotton industry cannot afford to sit down and dwell on its past. Times have changed, competitors are springing up, conditions have altered greatly, and good judges say that the cotton industry will have to fight as never before. This is possibly true, but there is nothing alarming in it. The trade has shown itself adaptable in the past and will do so again. What is encouraging is that it is showing a greater disposition than ever to call in science to its aid, and to consider its problems as a whole.—R. C.

TEXTILE MACHINERY EXPORTS

Pessimists and non-optimists—there are two grades—are shaking their heads over the fact that whilst the depression in the cotton trade continues, textile machinists as a whole are very busy on foreign orders. That activity exists whilst textile houses are recording losses, and even other engineering concerns, including the motor vehicle manufacturers, are disclosing adverse balance-sheets. It means, they say, more competition and concentrated competition for the cotton industry to face, and frankly they are not happy about it. It is pretty obvious that the export of this textile machinery and the buying up by foreign users of second-hand looms, means more competition. But there is the other side to the picture, and in all fairness that ought to be taken account of. After all, we are not going to be put down and out by the mere thought that others are coming into competition with us. It is a question of brains and energy and the will to do things, and in the past Lancashire has shown that she possesses these qualities in a striking degree. In the circumstances, the optimism of a man like Sir Edwin Stockton is a valuable asset. It may not yet have justified itself in fact in the way of a pronounced move in business, but none the less it helps to keep up the tone of things and gives heart to the industry as a whole. Therefore, let him continue to be an incurable optimist; he will have his reward in the long run, and he is doing the cotton trade a good service. There is nothing in the textile machinery situation to shake the position of Lancashire if she will only utilise her own material and mental resources to further her great export industry. The situation, of course, will none the less have to be visualised and we shall not have to underrate the powers of our foreign competitors. Nor shall we have to overrate them; of the two, the latter is perhaps the greater danger. —R. C.

GENERAL ITEMS AND REPORTS

FIRST ANNUAL MEETING OF EMPIRE COTTON GROWING CORPORATION

The utterances at the first Annual General Meeting of the above-named Corporation, held in London, on the 8th February, under the chairmanship of Mr. Stanley Baldwin, were of an interesting character, and there were some pointed observations in favour of a compulsory levy on the industry. Supporting the Chairman were Lord Derby, Lord Emmott, Mr. Walter Runciman, Lord Colwyn, Sir Hy. Birchenough, Sir F. Lugard, The Hon. Sydney Peel, Mr. Percy Ashley, Mr. J. W. McConnel, Mr. J. A. Hutton, and others, including the Secretary, Mr. Killby.

In moving the adoption of the report, the Chairman said he desired to pay a tribute to his two predecessors in office, Mr. Runciman and Lord Ashfield (better known as Albert Stanley) each of whom did all they could officially to help this great scheme. Hard and unseen work had been done by the Committee, and especially by the Chairman, Sir Hy. Birchenough, and Mr. J. W. McConnel. Great obstacles had been overcome and the Corporation as it now existed reflected the thoroughness of the work done. He was proud to see the result of co-operative individual effort, which was the kind of effort that had made this country. "Our trade has never been and never will be made by Governments," he added. In this Corporation they had the combined effort of all those interested in one of the greatest trades of the country. It represented a great act of faith and a great piece of pioneer work which would be an example and encouragement to every business in the country. It was the first great practical attempt of a great industry to cultivate our own Empire and to bring into production great tracts in the world not hitherto utilised. It seemed to him that if we devoted our brains and money to developing our Empire—and especially perhaps, to-day, the tropical parts—and cultivated the enormous markets in the East, we should be doing much better for our people than by fiddling with re-construction in the East of Europe. In the work of the Corporation, he saw an attempt on those lines which would be of the greatest help to all, quite apart from the development in the material sense. The fact ought not to be lost sight of that the cultivators of raw materials became potential customers. Turning to the annual report, he said he regarded the matter of the levy as a domestic affair, and he would like Government interference in this matter to be avoided. "'All I would now say," he added, " is that if you come to me and tell me that on your deliberate opinion it is necessary for the success of your Corporation that legislative power should be taken, and you convince me of that, I will do my best to induce the Government to give it their earnest consideration." The annual report touched upon the position in the Soudan. Recognising the importance of the status of that country being made clear and definite, he would undertake to do all he could to get the matter considered by the

Government and some conclusion arrived at as soon as possible. The first report of the Corporation was a document full of interest and full of hope for the future.

Lord Derby seconded, and said that both the British Cotton Growing Association and now this Corporation recognised that it was absolutely essential that there should be cheap and free raw material for the great cotton industry. It was obvious that, with America's growing demand and, he thought he was right in saying, lessened production, we must look further afield. And where better could we look than to our own dominions and dependencies? He ventured to hope that as time went on and the Government got richer—if ever it did—they might get even more money for developments to assist in something which would bring the Government a return in the form of employment and markets for goods. Regarding the question of the levy, he was convinced that the fairest and the right thing to do was to make it compulsory. In conclusion, he ventured to thank Mr. Baldwin for all he had done for the Corporation, and also Mr. Percy Ashley.

Mr. Walter Runciman, in supporting, said the Corporation was one of the few good things which had come out of the war. The problem which it had to meet was one of the most serious which could fall to the organisation of a great industry. He did not believe the British Empire could be entirely self-supporting in this matter, but, unless we were to learn from recent experience the necessity of not being almost entirely dependent on one source, we should be extremely foolish. Regarding the matter of a levy, the time might arrive when compulsion would be necessary, but he hoped it would not be necessary. It was to be hoped that all in the cotton industry would realise that the levy was in their own interests and also in the interests of the Empire. He detested the interference of Government in industry, and one of the great advantages of the Corporation was that it was to govern itself. The less Government control and parliamentary intervention, the better. He hoped the small minority would realise that it was their duty, both public and private, to get this matter on a sound basis. Under the careful scrutiny of the men who formed the Corporation, he had no doubt that the money available would go further than if it were controlled by Government officials.

Mr. Judson, speaking as representative of half-a-million operatives, declared unhesitatingly in favour of a compulsory levy and said the operatives would have to share as it was a levy on the trade. The operatives were just as keen as employers with regard to the success of the endeavours of the Corporation.

The Report was unanimously adopted.

INDUSTRIAL FATIGUE RESEARCH BOARD

The second annual report of the Industrial Fatigue Research Board recently published (H.M. Stationery Office: Price 1/6) covers the period from 1st April, 1920, to 30th September, 1921. The report states that, in consequence of the discontinuance by the Treasury of the financial provision, progress in some directions has been delayed. The proposal to transfer any important work in hand to the independent support of industrial or other voluntary associations—a proposal the Board had had no previous reason to expect—appeared likely to have most unfortunate results, and the Board made the strongest representations to the Medical Research Council against the abrupt termination of any parts of their work without inquiry into their value to industrial health or economy, or, again, into the practical possibilities of voluntary support being forthcoming from industries or elsewhere at short notice. The Board recognise that the steps taken by the Council to ensure continuance of the work have not only enabled them to avoid the sacrifice of many data already collected by them, but that they will permit of fresh investigation, though on a more restricted scale than previously. The Board are fully in agreement with the view that part of the executive and financial responsibility for their work should be undertaken by industries themselves. Steps are already being taken to bring about the formation of associations, constituted from groups of allied trades, to co-operate with the Board, and great hopes are entertained of agreements being reached in the case of certain important industries. It would, however, be over-sanguine to expect, the report says, any widespread response at the present time. In the first place, existing circumstances are unfavourable for the initiation of schemes based on ideas which in this country are almost entirely new. Again, industries for the most part are not yet fully alive to the importance of the human factor in production and to the still greater part this is destined to play in the future, and, until this is realised sufficiently to induce the spontaneous formation of organisations for the special study of this subject, some initial research must be undertaken by the Board alone with the object of indicating the methods to be applied and the problems suitable for future investigation. The practical value of the work must be clearly demonstrated before collaboration on the part of the industries can be hoped for. But in research of the kind undertaken by the Board, initial progress is necessarily slow and some time must elapse before the practical bearing of the results obtained can be fully developed. The Board have hitherto refrained from initiating research solely with the object of arriving at immediate practical results; they have, instead, preferred to study the more fundamental issues in the belief that by so doing such practical recommendations as may hereafter be made may be on surer ground. The difficulties of industrial research of this kind are formidable, and can only be fully realised by such as have had actual experience of it. Almost the whole of the investigations deal with a number of variables, none of which can be wholly controlled, and consistent results can only be secured by taking immediate advantage of opportunities as they offer, which under the industrial conditions of the last few years may suddenly lapse before investigation is complete.

The report, in conclusion, states that the Board are unwilling at the present stage to formulate any detailed schemes dealing with the method and extent of co-operation by industries. They suggest, however, that for the successful development of the work on the industrial side due regard must be had to the following considerations:—First, the Board are disposed to think that industries themselves should have a full and even predominant share in the supervision of such investigations, and in deciding upon the problems to be studied. The Board are concerned primarily with the acquisition of scientific knowledge; in the practical application of such knowledge, industries are the best judges of their own needs. Secondly, the Board regard it as important that responsibility for initiation and prosecution of the work should be shared as far as possible equally between employers' and workmen's representatives, acting together.

Part II. of the Report presents, in simple form and on a systematic plan, the principal facts contained in the published reports of the Board, collated and combined into three groups—(a) Hours of labour, (b) other conditions of employment, and (c) methods of work.

REVIEWS

YARN COUNTS AND CALCULATIONS. By T. Woodhouse. (Henry Froud, Hodder and Stoughton.) Eight chaps., 116 pp., 6/- net.

This publication deals with yarn numbering for single, two or more folded yarns, and the conversion from one system into another. One chapter is devoted to the solution of material costs and another to those of mixture yarns. The last two chapters are confined to a consideration of the variation of the number of turns per inch in different yarns, based chiefly upon the square roots of the yarn numbers—a subject in which some writers delight to indulge and formulate and evolve problems interesting in themselves but possessing little or no practical value. Of the eight chapters which the volume contains the first six have hitherto been extensively treated by various textile writers—and published in book form—including the author of the above volume, but under a different title. The treatise is well written, and should prove useful to those who chiefly require information on the various methods of counting single and folded yarns. —F. B.

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PROCEEDINGS

YORKSHIRE SECTION.

Meeting at Bradford, 23rd February, 1922, Mr. Henry Whitehead in the Chair.

FOREIGN EXCHANGES AND THEIR INFLUENCE ON TRADE.

By Sir JAMES HOPE SIMPSON.

The more I have studied the subject the more I have felt that it is beyond the power of the individual to solve the present exchange problem, even in the comparatively narrow sphere of his own transactions. In this matter, we are in the presence of economic forces so powerful and so far beyond individual control that I fear my remarks may give you little practical help. On the other hand, there is no existing economic problem which will require more skilful handling, and, therefore, none which deserves closer examination by business men. The solution will probably be a matter for international agreement, and if you and other British business men desire to see a wise policy adopted by Great Britain, and pressed on other nations, you must bring to bear on our Government the force of well-instructed opinion. Accordingly, I recommend you to steep yourselves in the study of exchange questions, and I ask you to accept this lecture as a first step in that direction.

At the outset, we must get into our minds a clear idea of the nature of our present difficulties. We all know that the state of the exchanges is seriously interfering with our foreign trade; but I want to try to visualize the way in which that interference operates, and I propose to quote a few cases where business has been prevented or rendered unprofitable by the abnormal condition of the exchanges.

In March, 1921, the Engineering and National Employers' Federations, in a pamphlet on the economic position of engineering, quoted a case where orders for 119 locomotives for Spanish railways were placed with six German firms. Depreciated exchange made successful British and American competition practically impossible.

In a recent case, tenders were asked for the supply of 10,000 tons of coal to France, the quotation being required in Francs and to remain open seven days. The firm's bankers declined to quote a firm rate for forward francs and to leave it open for seven days. Finally, the offer was made in sterling, payment to be made at a fixed rate of 53 francs to the £ if the exchange was 53 or over, or in sterling if the exchange was below 53. This offer was accepted, but the rapid depreciation of the German mark caused such uncertainty in French exchange that, finally, cover was arranged at 54.50fr. to the £, and, as a result, the British exporter suffered a loss on the business.

A firm in the chemical trade formerly had a large business in the export of bleaching powder to Holland. Last November, the German price was £8 5s. 0d. for 1,000 kilos f.o.b. Hamburg, against the lowest English quotation on that date of £13 10s. 0d. f.o.b. Liverpool—a difference which the British firm attributed to the external value of the mark being lower than the internal value.

Last October, a quotation was asked for from the Argentine for cast-iron pipes. The English quotation was $77 a ton; the German quotation was $42·89 a ton. The German contract was accepted, and Great Britain lost a contract of about £100,000. The difference between the German and English price was more than covered by the difference between the internal and external depreciation of the mark.

With the German rate varying round about 250 to 300 marks to the £, a certain firm was doing a considerable business in the export to Germany of fine cotton yarns for making gloves, umbrella covers, ribbons, etc. Since the rate has risen to round about 800 marks, the demand for this yarn has practically ceased.

A cotton firm contracted with a firm in Roumania to sell goods to them on a sterling basis, proceeds to be paid fourteen days after arrival of the goods. Payment became due in November, but in the meantime the restrictions of the Roumanian Government on exchange operations made it impracticable for the purchasers to remit funds. The exporters are still without their money, and the business has been brought to a standstill.

A firm in the woollen trade has supplied me with the following extracts from some Continental letters received by them, which may be interesting as shewing the question from the foreign importer's point of view:—

> A German customer writes: "I have given limits to my bank long ago for the purchase of English currency, but up to now it has not succeeded in any instance to make a purchase, as our mark fell to an enormous extent instead of improving as I had hoped. I, therefore, got into a very unfavourable position, as I cannot get near the price for the finished goods that I must pay for the yarn on account of the unfavourable rate of exchange."
>
> Another German writes: "It would at present be very difficult to sell your yarns here, as prices for these, resulting from the very high exchange which is quoted for the £ in Germany, would be much too high. Therefore, practically without exception German wool yarns are used in this district now."
>
> Yet another German writes: "We are unfortunately not in a position with the present bad state of the market to work with English yarns. The cause of this depression in the mark exchange must not be unknown to you. It is caused just by the loss of Silesia. Should our Exchange once more improve, and in that manner put us in a position to buy the £ cheaper, we will then effect a purchase with you."
>
> A Frenchman writes: "We are in receipt of your letter, as well as of the two samples, which we found quite suitable, but *because of the exchange* we find your prices too high."

I understand that, speaking generally, Bradford exporters have sold their goods on a sterling basis, and have thus, again speaking generally, escaped loss in exchange, but where there has been delay in payment, or where goods have been consigned abroad to be sold in either sterling or currency, the terrific fall in values of the Continental currencies has often resulted in considerable loss. Often, too, adverse exchange rates have stopped business altogether.

From the instances I have quoted, and many others which I might quote if time allowed, it appears that the stoppage of business or the loss inflicted on British firms is due to the following causes:—

(1) The extreme depreciation of many of the Continental currencies.

(2) The extreme instability of exchange rates, which makes the result of many transactions quite uncertain.

(3) The competitive advantage which German exporters enjoy owing to the fact that the value of the mark, when used as currency inside Germany, is greater than its value in foreign exchange.

A less apparent but nevertheless a very potent cause is:—

(4) The fact that in most countries movements of the exchanges have ceased to operate as a readjusting and regulating influence on prices and credit.

Examining these causes one by one, I take, firstly, the extreme depreciation of many of the Continental currencies. The chief cause of this great depreciation is the unceasing issue of paper money. The rate at which the currency of one country will exchange for that of another depends chiefly upon the purchasing power of the two currencies inside the respective countries. If one £ sterling will purchase in

England the same amount of commodities as 20 marks will purchase in Germany, then the rate of exchange between England and Germany should be about 20 marks to the £ sterling. If Germany, however, swells her currency by issuing millions and millions of inconvertible mark notes, while the currency of Great Britain does not materially increase, the purchasing power of Germany's currency will depreciate, and the value of the mark will fall in relation to the £. This is precisely what has taken place. The German index-number of wholesale prices increased from 100 in 1913 to 3,416 in November, 1921, which means that the mark is only worth one 34th of its pre-war value. The main reason is that Germany's note issue has increased from 2,013 million marks on 30th May, 1914, to 115,375 millions on 31st January of this year. The corresponding British index-number only increased from 100 in 1913 to 176·4 in November, 1921. On this basis, the purchasing power of the £ sterling is about two-thirds of its pre-war purchasing power. Giving effect to the depreciation of each currency, the rate of exchange should be about 450 marks to the £. In practice, other prices besides wholesale prices, and other considerations, have to be taken into account in fixing the rate of exchange, but the figures I have just given are enough to account for a large part of the depreciation of mark exchange. I shall explain later why the actual rate is nearer 900 than 450.

In regard to the depreciation of the currencies of other countries of Eastern Europe, similar conditions have produced similar results.

Now turn to the second cause of our exchange difficulties, namely, the extreme instability of the exchanges.

Before the war, the movements of rates of exchange were usually strictly limited, and, so far as ordinary business transactions were concerned, did not often interfere with or stop business. The reason why exchange movements were limited in extent was that in practice they were limited by the cost of shipping specie from one country to another. For example, if a Frenchman in Paris owed £100 to London he usually paid the money by purchasing in Paris a cheque on London for £100 and remitting it. The par of exchange between London and Paris is 25·22, which means that 25·22 francs represented under French law exactly the same amount of fine gold as £1 did under English law. The cost of remitting gold from Paris to London, or vice versa, was 10 centimes per £ sterling. Accordingly, the Frenchman would be prepared to purchase a cheque on London at a rate not exceeding 25·32 francs to the £, being 10 centimes above the par of exchange; but he would not be prepared to pay more than 25·32, seeing that at that rate he could obtain actual gold and ship it to London. Similarly in the case of an Englishman requiring to pay in Paris the equivalent of £100; he would not be prepared to accept a cheque on Paris for less than 25·12 francs, seeing that if the rate fell below 25·12 it would pay him better to ship the gold from England to France.

The same rule applied to the dollar-sterling exchange. The par rate is $4·866 to the £, and the cost of shipment of gold either way was, before the war, about 3 cents per £ sterling. It followed that in normal times the limit of rise of the dollar-sterling rate was about 4·89½ and the limit of fall was about 4·83½. It was only in time of panic or unusual disturbance, such as occurred at the outbreak of war, that the rate of exchange moved beyond those limits, which were known as the "gold points." We may take it as a general rule that, as between countries which had a gold standard and a free gold market, the rates of exchange seldom moved beyond the gold points.

As between two countries, one of which, such as England, had a gold standard, and the other, such as China, had a silver standard, the question of fixing the rates of exchange became more complicated. Par of exchange would no longer be steady, for with one country on a silver standard and the other on a gold standard the monetary unit of one would have no fixed relation to the monetary unit of the other. The value ratio of those units would vary with the value ratio, in the bullion markets, of silver and gold, but even in this case the rates of exchange could not go above or below the current par rate by much more than the cost of shipping specie. Thus, the rate of exchange in London for bills on China could not go higher than the cost of silver in terms of gold plus the cost of shipment of the silver.

In the case of two countries, one of which had a gold standard and the other an inconvertible paper standard, as was the case between ourselves and the United

States during the American Civil War, the par rate of exchange depended chiefly on the cost of gold in terms of the inconvertible paper, and the fluctuation of the rates of exchange above or below such par were again limited by the cost of shipping gold.

When two countries both have inconvertible paper standards, then, so long as gold is the medium for settling international balances, their rates of exchange will depend on the value of both currencies in relation to gold, and the fluctuations, upwards or downwards, would again be limited by the cost of shipping specie. Where, however, the shipment of specie is prohibited, as it is at present between this country and Germany, *there is no automatic check upon fluctuations of the rate of exchange.*

Except in the case of United States, the practice of settling international differences by shipments of precious metals has been discontinued. The usual limits of exchange fluctuations have therefore disappeared, and this is the main reason for the extravagant movements of the rates of exchange between ourselves and other countries, and between those countries and one another. Such fluctuations have an extremely prejudicial influence upon business. In pre-war days, rates of exchange seldom moved to such an extent during the currency of a mercantile transaction as to affect its result seriously either to buyer or seller. Now the movement of the rate is often a main factor in the transaction, and there are few things more generally affecting the foreign business of this country as uncertainty at home or abroad with regard to the way in which rates of exchange will move during the course of a transaction. There is no metallic link between the currencies of the different countries; no settlement of international differences by shipment of the precious metals, and therefore no automatic limit to the rise or fall of the rates of exchange.

The third cause of our troubles is the fact that the value of the German mark in internal use has not depreciated to the extent to which it has depreciated in relation to foreign exchange. Whence comes this difference? I have shown that if there were no elements in the case except the purchasing power of the two currencies, the rate of exchange, between England and Germany should stand at about 450 marks to the £, but the rate is actually 900, and has been as high as 1,300. The explanation is, firstly, that while any plethora of marks in the exchange market is immediately reflected in the rate of exchange, the depreciation of the mark in internal use is a gradual process, for it takes a long time to adjust prices and wages to the falling value of the mark; secondly, that Germans anxious to convert their depreciating mark into more stable currency, or anxious to provide funds in dollars, pounds, or other foreign currency, for the purchase of raw materials and other imports, throw their marks on the exchange market at almost any price; and, thirdly, that the German Government is a constant buyer of foreign exchange for the purpose of reparation payments. The mark is thus continually pressed for sale abroad, and its exchange value falls.

If this pressure to sell could be avoided, the internal and external value of the mark would gradually draw together, and German exchange might become stable somewhere in the region of 600 marks to the £, which might then be regarded as par, or, to use the phrase coined by Professor Cassel, as "the purchasing power parity." Business between Germany and other countries would then become possible, and the advantage which German exporters enjoy and the drawback from which German importers suffer, by the divorce of the rate of exchange from the internal purchasing power of the mark, would disappear. As towards Germany, we should then be in the pre-war condition of competitors on a normal basis.

I pointed out that the final cause of our exchange difficulties is the fact that in most countries the movements of the exchanges have ceased to operate as a readjusting and regulating influence on prices and credit. May I ask you to cast your minds back to pre-war days and revive your recollection of what happened in normal times when rates of exchange moved up or down.

Taking American exchange by way of illustration, when exchange rates went against this country and gold had to be shipped to New York, the effect was to diminish the amount of gold in Great Britain. Gold in Great Britain, accordingly, became more valuable in relation to other commodities; but as gold, in this country, was not only a commodity but also the standard of money and prices, the effect of a rise in the value of gold was to lower the price of other commodities when measured in gold. In other words, when gold had to be shipped to America the tendency was for prices in this country to fall. The effect of falling prices was to attract foreign buyers, that is, to promote exports from this country.

Again, when the gold shipments reached America, the opposite effect was produced. The stock of gold in America was increased. The value of gold in relation to other commodities tended to fall. In other words, the price of other commodities measured in gold tended to rise, with the result that America became a dearer market for foreigners to buy in, and exports from America were checked.

A further effect of a fall in dollar exchange, and especially of actual shipment of gold to America, was to stiffen rates of interest in the London money market. Indeed, if the shipments of gold looked as though they might be persistent, bank rate was usually raised, and all other interest rates in the London market followed suit. The effect of this was, in the first place, to attract foreign funds to London, and in the next place to check any tendency towards inflation of credit in this country, and, therefore, to make it more difficult for us to import foreign goods and more eager to export our own goods. Accordingly, both in regard to price movements and in regard to credit, the fall in exchange and the subsequent shipment of gold exercised a remedial influence; it checked imports, promoted exports, and generally discouraged any tendency to over-trade. But it did more than this; it gradually restored the equilibrium of trade between ourselves and America or the other countries concerned, and finally tended to throw the balance of trade in an opposite direction, with the result that rates of exchange began to move in favour of this country, and, in the old phrase, the exchanges were "rectified."

This powerful influence of the exchanges, operating automatically—very much on the same principle as the governor of a steam engine—is one of extraordinary interest to the student of economics; but it is also of the utmost practical value to all engaged in international trade, and, until its operation is restored, the trade of the world will not run smoothly—it will only jolt along.

I think I have said enough to establish the fact of the existing chaos of the exchanges, and to explain the main reasons why it is stifling the foreign trade of this country, but it would be a mistake to think that we are the only sufferers.

A financial correspondent of one of our leading newspapers, writing from New York the other day, said:—"German competition has left a trail of ruin in American industries scores of factories have been shut down, and thousands of people are workless because American manufacturers find it impossible to meet prices that are a third to a fifth lower than the cost of production in this country." He then proceeded to give instance after instance of German under-selling, and he ended by quoting the words of a Labour representative, who said: "Summed up, one ounce of gold will buy 17 hours of labour in the United States, 97 in Japan, 117 in France, and 201 in Germany."

Accordingly, America, equally with ourselves, is a sufferer from the disastrous exchange position.

If we enquire how Germany and other countries with depreciated currencies and disorganised exchanges are themselves getting on, we shall find that it is not all sunshine.

The other countries may be dismissed in a few words. In Russia, foreign trade is practically extinct, having been killed by the deliberate Bolshevik policy of multiplying rouble notes indefinitely, and thus destroying exchange values.

In Poland, the extreme depreciation of the Polish mark is hampering trade, especially imports, and a considerable amount of trade has to be carried on by barter.

In Austria, the Government only last week hoisted signals of distress, and it is now recognised by our own and other Governments that if Austria is to be saved, economically, it can only be by the assistance of other countries.

But what about Germany? Germany is passing through precisely the economic, commercial, and social experiences which always follow unlimited issue of inconvertible notes. The purchasing power of the notes steadily declines. Prices of commodities, measured in notes, steadily rise. It is difficult to avoid making profits, and business inside the country receives a constant stimulus from the rising prices. Factories are full of work, wages go up, fresh enterprise is embarked on, and the whole country presents an appearance of extreme prosperity. France went through the same experience with her Assignats. The United States went through it at the close of the Revolutionary War. Japan went through it between 1878 and 1884; and other similar cases could be cited. It is true that along with this prosperity a great and undesirable social change takes place. All persons with fixed incomes or with salaries which do not rise like trading profits or workmen's wages suffer severe hardship because of the advance in the cost of living, and these classes include, in Germany and in most countries, the leaders of thought, education, science, government, and the professional classes generally—in short, the brain of the nation. It is also true that violent speculation on the stock exchange and in other directions is induced, and that the ordinary checks upon business recklessness disappear. However, if Germany could stop her issues of bank notes, even now, it is possible that she may have reaped the advantages of material prosperity and may gradually rectify the social change to which I have referred. But, can she stop? According to all historical precedent she is on an inclined plane, and there seems no way of stopping till the bottom is reached, that is, when the mark, like the rouble, ceases to have any purchasing power worth naming; when peasants refuse to bring their produce to market; when holders of goods cling to them because of their intrinsic value and refuse to exchange them for worthless paper; and when the foreign trade, which Germany has laboriously and industriously built up in spite of post-war difficulties, is thrown back on to a system of barter.

I do not say that all this will happen, and it is certainly highly desirable in the interests of the world that it should not happen, but that, on the contrary, the economic systems of Germany, Austria, and of all the countries with depreciated currencies should, if possible, be preserved; but I do emphatically say that this can only be by the immediate stopping of issues of paper currency.

In the meantime, we need not envy Germany's foreign trade. Taking the latest figures available, the average monthly volume of her imports in 1913, calculated in metric tons, was 6,068,000 tons, against our own monthly average of 4,466,000 tons. Her imports for November last were 2,535,000 tons. Our imports for October last were 3,365,000 tons. On this basis, the volume of German imports had fallen by 58 per cent.; ours had only fallen by 24·7 per cent. Germany's average monthly exports in 1913 were 6,143,000 metric tons; ours were 7,737,000 tons. Germany's exports for November, 1921, were 1,908,000; our exports in October, 1921, were 4,364,000 tons—Germany's had fallen by 69 per cent., and our own by 43 per cent.

Again, *we* are passing through, and, I hope, are gradually nearing the end of, our collapse of trade after the war. Germany's collapse has yet to come; so that, troublesome, irritating, and to a certain degree calamitous, as German competition is for us at present, I would rather to-day be a British business man than a German business man.

The last thing we want, however, is to see Germany and the countries with depreciating currencies follow the path of Russia. Puzzling and difficult as are the problems which confront us at present in consequence of the chaotic state of the exchanges, our problems would be vastly increased if those countries were to land in financial collapse.

The question, therefore, is: What is to be done? It is possible that nothing can be done but to allow events to take their own course, and to let Germany and the other countries in similar case go on shewing deficiencies in their Budgets and meeting these by increasing issues of inconvertible paper currency; but I have met no leading British financial authority who does not earnestly desire to prevent such a development. It is recognized in this country, and I hope it may come to be equally recognized by the statesmen and leaders of all the principal countries of the world, that no effort must be spared to avert the catastrophe of the economic collapse of what is, after all, by far the larger portion of Europe. We, above all others, cannot stand aside and fold our hands. Before the war, Germany was, next to India, our chief customer. The other European countries were also valuable customers, and I never came across any sensible business man yet who did not strain every nerve to save a good customer who had fallen upon ill times, and who, if put upon his feet, would prove a good customer again. You business men of Bradford adopted this principle in many cases during the past twelve months, and you know you will gain by it. In the same way, we, as a country, have everything to gain by attempting to avert the catastrophe which threatens to overwhelm some of the nations who have been among our best European clients.

I now have to ask whether anything can be done to restore the foreign exchanges to normal working order.

So far as the exchange problems of individual business firms are concerned, I am afraid I can only give you cold comfort. By making forward contracts in exchange, protection against loss may fairly often be obtained, and each business man will be able to decide for himself, in respect of each of his transactions, how far this method can be adopted; but in many of the most important business proposals there is a period which cannot be covered by a forward contract. As an illustration, I may quote a case which came before me the other day, where a British company wished to tender for a large continental contract. As they were not certan their tender would be accepted they could not cover the exchange by a forward contract at the time of tender. During the interval of a month between tendering and receiving the announcement of the result of the tender, exchange might move against them, and a tender, which was justified on the rate of exchange ruling at the time it was made, might become a losing proposition. It was found impossible to get any protection against such a contingency. The result was that the tender was not made, and a contract worth £130,000 was lost to this country.

Again, even in the case of an order for goods being definitely given by a continental importer, and the goods being actually shipped, and exchange covered by a forward contract, there is no absolute guarantee that in the event of exchange moving violently against the continental customer, he will be able to take the goods up when the date of payment arrives. The British exporter is then left in the position of having to complete his side of the forward contract at a loss, because he has failed to receive the continental currency which he expected to receive from his continental customer. Thus, even a forward contract is not always complete protection against loss caused by violent fluctuations of exchange during the currency of a transaction, and I am sorry I can suggest no other means of protection. The root of the evil is the extreme instability of the exchanges, and this is beyond individual control. The truth is that the main problem can neither be solved by individuals, nor even by individual nations; it is an international problem, and can only be solved by international agreement. With great deference, I now venture to suggest the lines along which I think a solution may be found.

The first and indispensable step is to secure that the purchasing power of the various depreciated currencies within their respective countries shall be *stabilized.* This can only be done by stopping all further issue of inconvertible paper money, and this, in turn, depends upon the balancing of the Government budget of the country concerned.

Czecho-Slovakia, almost alone among the Eastern continental states, has succeeded in balancing her budget and in stopping further note issues. Even when she had to mobilize an army on the occasion of the recent irruption of the Emperor Karl into Hungary, she managed to cover the expense without creating a deficit in her budget; but it remains to be seen whether her good example can be followed by the other countries whose budgets, up to the present, have not balanced. The governments that cannot cover their expenditure by taxation are compelled to cover it somehow, and, so far, many of them have done so by borrowing from their state bank, which, in turn, has to find the money by increasing its note issue. Accordingly, the first and absolutely essential step is that budgets shall be made to balance and further note issues cease.

The next step is to gradually abolish the difference between the value of the depreciated currency in foreign exchange and its value in internal use. This would gradually come about through the natural working of the law to which I have referred, that the currencies of two countries tend to exchange on a purchasing power parity; but in a case like that of Germany, where so many marks are held outside the country, the movement might be hastened if Germany could offer to foreign holders of marks a German Government loan in exchange for their marks. The terms would have to be tempting, but, if the loan were successful, it would remove a serious obstacle to the assimilation of the internal and external value of the mark.

Simultaneously, such a method of effecting reparation payments should be adopted—if it is possble to find one—as will prevent the Sterling, Francs, Lire or other Foreign Currency required, from being purchased by means of the sale of marks outside Germany, and this, for two reasons. The first is, that if the reparation moneys are provided by the sale of marks abroad and the marks subsequently depreciate, as they have done in the past, the purchasers who happen to belong to the countries receiving the reparation payments are, to the extent of their loss, providing the reparation themselves. The second reason is that every further sale outside Germany of German marks will tend to depress the exchange value of the mark and prevent the assimilation of the internal and external value of the mark.

The next step would be to re-establish a metallic link between the exchanges of the different countries so as to get back to the position which I have described, where a mint par of exchange exists between the several countries and international differences can be settled by shipment of specie. Within the limits of this address, I have not time to discuss fully what the links should be, and by what stages they should be established, but I was glad to observe that the Chancellor of the Exchequer has stated that "It is the intention of His Majesty's Government to promote the re-establishment of an unrestricted market for gold in London at the earliest date at which the state of the exchanges renders this course possible and desirable." If unrestricted markets for gold were also re-established by other countries at present possessing considerable stocks of gold, and currencies very little depreciated, it is possible that after certain adjustments, by shipment of gold, in respect of current international indebtedness, the exchanges between those countries, America, and ourselves might settle down to their pre-war condition of stability. It is also possible that countries whose depreciated currencies may have been stabilized might by one device or another have their currencies linked up for exchange purposes with the currencies of the countries who may have thus established unrestricted gold markets. On the other hand, the re-establishment of free gold markets here and in other countries of Europe will have to be most carefully considered before the step is taken. The present state of American exchange, for example, in spite of the recovery of the £ sterling, indicates the existence of considerable current indebtedness, and America would apparently have power to draw gold from us in large quantities if we had a free gold market. It would probably be to her own interest to avoid such withdrawal, but economic conditions might make withdrawal inevitable, and our stock of gold might be drawn away or seriously reduced.

Against this risk, however, must be set the enormous advantage which would accrue to us and to all nations by the re-establishment of stable exchanges.

The nature of the link to be established between the depreciated currencies and the currencies of the gold standard countries also calls for earnest consideration. The countries with depreciated currencies may not find it possible to adopt a gold standard; some may adopt a silver standard; others may not be able to adopt any metallic standard; but the essential thing is that their international differences shall be settled in specie. Even before the war, there were countries such as India, Brazil, and Greece, who used to keep their exchanges efficiently regulated without the necessity of holding a large stock of gold at their own financial centres. They accomplished this by the use of an exchange standard known as the "Gold Exchange Standard." Under this system, the country which uses it maintains a credit in London or some other centre, on which it is able to draw in order to meet any balance of claims presented to it. The system worked well before the war, and it may be that, by its means, depreciated European currencies may be linked up for exchange purposes with currencies based on one or other of the precious metals.

Whatever links are adopted the pars of exchange established between ourselves and countries with depreciated currencies will probably be totally different from pre-war pars, but this would not interfere in the least with foreign trade, so long as the new pars coincided approximately with the purchasing power parities of the several currencies.

Hand-in-hand with these economic measures, there will require to be close political and commercial co-operation between the nations of Europe. The idea that, because the nations are trade rivals, the misfortune of one benefits the others, is as extinct as the Dodo. The war has taught us many things, especially in economics, and nothing more clearly than the economic solidarity of the nations. It has also taught us that foreign trade is nothing but exchange of goods, and the greater the volume of goods exchanged, the better is the state of foreign trade. Therefore, all obstacles to the free exchange and transport of goods will have to be swept away and customs tariffs reduced to the minimum required for revenue-producing purposes. Again, reparations will have to be fixed on such a scale, and methods of payment so arranged, as to produce the minimum of economic disturbance. Finally, a wise step would be the mutual cancellation of inter-allied Government debts. While it is true that these have not yet actively affected the foreign exchange market, because few great payments of principal or interest have so far been made, the knowledge that they exist and that, sooner or later, payments of principal or interest may be called for, tends to keep alive a state of anxiety and uncertainty.

You will probably be disappointed that I have not been able to indicate any *immediate* solution of existing exchange difficulties. No immediate solution is possible. Further, while I have put forward certain suggestions for international action, I realise keenly the incredible difficulty of carrying them into execution. The trouble is that no authority exists sufficiently august to impose its will upon the individual nations. If any schemes, such as I have indicated, are to be carried through, it will only be by the exercise of infinite patience, infinite skill, and the most generous co-operation of the statesmen of all the nations concerned. Nevertheless, we must not be discouraged. What is occurring in the world is the natural result of the enormous destruction of treasure and human life, and of the political and social upheavals caused by the war. As Professor Gregory points out—" The idea that the whole world can turn the greater part of its resources, in men and goods, to the purposes of destruction without destroying its own wellbeing, can only be entertained by those who are ignorant both of history and of the teachings of economic science. The lack of confidence and of hope in the future induced by the Peace Treaties, the post-war expenditure on armaments by bankrupt and semi-bankrupt Governments, the post-war tiredness, are all features that in the aggregate weigh very heavily."

All this is more than true, and yet I believe that in the Providence of God the way for restoration of the wellbeing of the world is gradually opening. I believe that statesmen of all countries are beginning to realize the urgency of international co-operation. I have also great faith in the persistent individual effort of innumerable earnest men in all lands each to solve his own particular problem and the problems of his own community. And if any further ground for hope is desired, it is to be found in the fact that, in many minds among the civilised races of men, there is growing the conviction that not by war, nor by economic strife, but by mutual service and goodwill is the welfare of the World to be restored and maintained.

LANCASHIRE SECTION.

Meeting at Manchester, 13th December, 1921, Mr. B. Robinson (Oldham) in the Chair.

CONTINUED EDUCATION.

By Harold Rostron, B.Sc.

If the instruction given in elementary schools can be regarded as dealing with the fundamentals of education, then we may say that the purpose of Continued Education is (*a*) General : for the further development of the faculties and for giving an all-round knowledge; and (*b*) Special : for the particular needs of the individual (1) for purposes of his occupation, and (2) for intellectual pursuits in art, literature, or science.

The responsibility for giving this continued education is therefore upon :—(1) The State for " foundation " education; (2) The industry for occupational education; (3) The Individual for selected cultural education; and this order may be taken as the order of necessity, and, therefore, of operation. It will be convenient to consider such a scheme in its relation to the existing provision of education.

It is hardly worth while to give an exhaustive review and criticism of the work accomplished in elementary schools, for the discontinuance of half-time exemption and the raising of the leaving age will remove heavy burdens under which the teaching has suffered in those schools, and will now allow, for the first time, that teaching to be judged fairly on its results.

The kind and extent of instruction that should be given for a general foundation education is one which should be left to educationists, provided that they regard their work not as an end in itself, lost in the indefinite infinity of academic philosophy, but as having some substantial relation to the established claims of occupation and individualism. The opinions of educationists on the various questions involved are so varied that, out of free and extensive discussions, there should, some day, be evolved a system so true in its balance that it will have due regard to the claims of the humanitarians, the utilitarians, and any other " arians " who may appear in the meantime, and will be suitable to the later requirements of occupational and cultural pursuits.

For instance, the secondary school system has much to recommend it as continued education, particularly leading up to professional occupations, but its proposed substitute for industry, viz., the day continuation school system, could not afford so full a curriculum, nor so extensive treatment, and there should be a measure of its possibilities as between elementary education and industry when the requirements and duties of that part of our educational system are brought into the completed scheme of continued education.

I had the honour of presenting to the 1919 Conference of The Textile Institute a suggested scheme of instruction in day continuation schools, and after three and a half years' experience of working a day continuation school closely connected with the textile industry, am confirmed in my opinion that such a scheme, while contributing to a general foundation education without giving vocational instruction, gives due regard to the later requirements of vocational instruction as well as a continued general education.

The requirements of occupational education should be carefully determined and safely secured by industry from within, at the same time calling in professional educationists where desirable; and, as an example, the textile industry should apply itself to the problem of employing education to the utmost extent in the service of the textile trade.

This has been done for many years through the City & Guilds of London Institute, where representatives of industries and representatives of educational institutions have prepared syllabuses of subjects, held examinations on them, and issued certificates of success in separate subjects. But the claims of educationists have had allied subjects added to the technological subjects in the conditions of award of certificates.

The Union of Lancashire and Cheshire Institutes has further extended technological instruction by arranging graded grouped courses in various trade subjects, including cotton spinning, and cotton weaving. These courses are graded to meet the requirements of operatives as far as the 3rd year's course, with extended courses in the 4th and 5th years for mill managers.

The constitution of the Union of Institutes provided for representatives of Education Committees, including members of those Committees and Directors of Education, representatives of teachers engaged in teaching the various grouped course subjects, H.M. Inspectors of Secondary, Technical, and Evening Schools, and —in cotton spinning and weaving—representatives of the City & Guilds of London Institute. Where the teacher representatives are engaged in the textile industry—either in textile engineering works, spinning mills, or weaving sheds—there is, incidentally, direct connection with the textile trade, but the industry might be more closely connected with the U.L.C.I. (now one of the largest educational organisations in England) if the Textile Trade had representatives directly appointed to serve on that Union of Institutes.

In furthering the interests of the textile trade, regard should be paid to the needs of operatives, overlookers, managers, and leaders of the industry.

Beyond the courses of instruction under the U.L.C.I. there is the Graduate Course in Cotton Technology at the Manchester College of Technology for students not less than 16 years of age, of matriculation standard, and who can attend whole-time for three years. This may be taken as a continuation of the senior courses taken in evening technical schools, or as a continuation of the education received at one of the public schools, or in the higher courses at a secondary school.

The question as to how and when a student should acquire experience in the cotton mill—as a complement to a university course instruction in cotton technology—is one which may advantageously be considered by representatives of the industry and of the educational institutions.

This course of continued education through U.L.C.I. courses at evening technical schools and the degree course at the College of Technology is obviously too detailed and laborious for purposes of the Manchester warehouse branch of the trade; and a useful course in commerce of textiles for their requirements is provided in the evening department of the Manchester College of Technology involving attendance on three evenings a week for not less than three years, leading to the Associateship of the College. For men who are qualifying for leadership in the cotton trade, it is desirable that there should be a special course at the University in some of the subjects for the Degree in Commerce.

The research branch of the textile industry may require either (1) other subjects of instruction, or (2) further treatment. It is urged that instruction in the physics of the cotton fibre, yarn, and cloth is only slightly touched upon, although a knowledge of it is of increasing importance. It is said that, in the technical schools, while the operative is taught much of the operations of the various machines, he is taught quite too little about the changes which those operations produce upon the fibre, and also about the relation of the physical properties of the fibre to the effects required to be produced. There is, therefore, a claim for advanced instruction in physics generally, and specially in the physics of the cotton fibre, to be given in a thoroughly scientific manner, and more in the nature of a post-graduate course to advanced students.

At present, the hall-mark of technological certificates in textile subjects is given by educational institutions alone, but it would do much to combine education and the textile trade, and would also considerably enhance the value of those higher certificates, if, through some official organisation, the textile industry itself were to endorse those certificates. While it is not to be argued that the man with the best certificates is consequently the best operative or manager, it is more than likely that the best men for the texile industry will be found amongst those who hold such certificates, rather than amongst those who have neglected to take up such instruction.

For modern mill management it is difficult to see how a man can, in the time spaced out to him to merit such responsibility, fit himself for the work without strenuous study over a good number of years. There appeared a report in the newspapers the other day that Lord Emmett had stated that he knew one case of a man who was a medallist in a textile technological subject and was a fool in the mill, but a case has also been quoted of a fool in the mill being the best operative, and it might be argued from these two cases that the term "fool" requires to be considered under the theory of relativity, that education is of no account in the mill, and that fools make good operatives. There are some who have suggested that day continuation school education is quite unnecessary for the ordinary operative in the Lancashire cotton industry, but surely that industry must benefit by employing more skill and intelligence, and, whether it needs education or not, we certainly do not need to cultivate ignorance to have enough of it, and woe betide that industry whose workmanship and supply of labour are dependent on ignorance. I can assert with full assurance that young operatives who have attended one day continuation school, where they have had systematic instruction in the subjects of the curriculum outlined in my previous address to this Institute, have shown a quicker intelligence, a more ready application, a considerably healthier and better developed physical constitution, and more pleasing manners, improvements which have not in any way detracted from the efficiency of their work in the mill, but have contributed to a quicker interest in their work and made them much more desirable colleagues at work.

No special course of education can be laid down which may claim to possess proprietary rights to developing intelligence, adaptability, resource, self-reliance, foresight, enterprise, and courage. Education—either classical or scientific, humanitarian or utilitarian—if given and pursued in the right manner, should make a man better fitted for his work. The textile industry cannot maintain its present position if it depends on operatives, managers, or leaders who are said to be "born to it," nor can it afford the cost of training by experience.

Speaking generally, and for purposes of a policy, one may be sure that whatever work a man does in this industry, he is better fitted to do it with the help of education than he is without education. And if, with the education he has received, he is personally not fitted for higher work than his own job, he has a more enlightened mind, he has a vital interest in his work, he is a more reasoning and intelligent workman, and he is a much safer and more helpful citizen.

Let no young man make the mistake that certificates of examination successes entitle him to promotion or higher wages. Too many scholarship students in cotton technology have already made that mistake—thinking they should be appointed as managers or under-managers as soon as they left the technical college. While pursuing education to acquire better qualifications for their work, let them always keep before them the thought that education is worth pursuing for its own sake and is its own reward.

DISCUSSION.

The CHAIRMAN said the subject of continued education was one in which he had taken interest for a good many years. He was glad that the lecturer had taken the view that the industry, and those carrying on the industry, must have some power to decide the form of education to be given to its students. The lecture raised the question as to when a person should receive his continued or specialised education. He was strongly of opinion that a man should first go to the mill and from his experience there continue his education. A student at the College of Technology or the University should not break his connection with the mill, for if he was going to be a leader of industry he must not be taken away altogether from his work. Under the present scholarship arrangement a student must be taken away from the mill. Why could not a student continue with his work whilst advancing his education? A youth who came into the mill, or returned to the mill, at twenty or twenty-one years of age had yet to find whether he was a success in his occupation or not. On the other hand he knew of youths who had continued their education from the mills and to-day they were holding responsible positions.

A speaker expressed the opinion that some of the young men who came to the mills from the colleges and universities thought that they knew more than the manager, and they would not get down to the real work. The man from the college had obtained all his knowledge from a book. He would not get his jacket off and get at the work. He left all the heavier and dirtier work to someone else.

Mr. S. H. HIGGINS (Manchester) said it was difficult to define as to who was a practical man. Many people said that a man could not be practical unless he had entered the mill at 10 years of age, and that a man who had not gone through a mill from the very beginning could not be practical. When a man had entered the mill at seventeen years of age, the other men would at once say he was not practical. It was a very silly view to take. The practical man was the man with the keenest powers of observation, and, to his mind, he was the only practical man. If education assisted him to improve his powers of observation then he became a practical man. For a man who went into the mill at ten years of age, and who had no power of observation, to consider himself a first-rate practical man was an entirely erroneous view.

Mr. W. MYERS (Manchester) said that, speaking from an experience of teaching extending over a good number of years, the men who stood out foremost, in his opinion, were the men who had had one or two years' experience in the mill, followed by three years at the college, and who had then returned to the mill. The youth who had been in the mill was much more appreciative and keener in taking things in than the youth who came from secondary or public schools. That was the type of man who was going to make the most of his technical training. He did not think it was true to say that the students on leaving the colleges expected to be managers straight away. What they did want was to get a fair chance, for a fair chance they did not always get.

Mr. J. H. LESTER (Manchester) agreed that industry should speak for itself regarding the education of those who were to be trained for the industry. He thought, however, that there was a little misunderstanding in some minds as to what they were aiming at—those who were to be trained for leaders of industry and those to be trained for operatives. The general impression seemed to have got abroad that the manager should be trained as a leader of industry. To his mind that was wrong, as the number of managers throughout the whole industry holding big salaries and qualified to be leaders of industry was extremely small. It was to a manager's advantage to get as much education as ever possible. With regard to education the Textile Institute might do something of considerable value for the industry in saying what the industry required. That would, however, be a somewhat difficult task. He did feel very strongly that the curriculum now in force for the early years of general education should be carefully revised by the industry with the object of finding out whether it could be made more useful than at present for particular vocational purposes. For the purposes of the leaders of industry education must include a deeper grounding in science. He had a feeling that much of the science taught was useless in its practical application because it did not go far enough.

Prof. A. J. TURNER (Manchester) said that often a system of education was blamed for certain results when it was not the system that was at fault at all but the individual on whom the system had been operative. If sometimes education did not do something one might expect, it was not necessarily the system of education that was at fault. He had heard it said that the men who obtained scholarships did not always go back into the mill. It was contrary to fact to say that everybody who had had continued education used it with the idea of getting out of the mill, never to return. During the last few years half of the students at the Manchester College of Technology had gone back to the mill. It had been said that a man from college would not take his coat off because, it was urged, of his education. That was a case of the individual. If it was the general result that when men returned to the mills they would not take off their coats to their jobs then he would agree that the system of education was at fault. That statement was contrary to what he knew of individuals who had gone back into industry from full-time courses of education, and, therefore, he disputed it. If a student passed out of an institution with a degree he might overrate the value of that degree. It was a tendency which those engaged in educational work tried to remove. They did their best to point out that the obtaining of a degree did not, in any way, say that a man was suited to a management post. They did not attempt to train operatives or managers by education. What they did was to give them a tool which they might, under circumstances, be able to use. The students might use it or they might not—that was not the fault of the teacher.

The lecturer referring to the statement that a college man would not take off his coat to his work, said there was nothing in the instruction given that should make a man have such warped ideas.

A vote of thanks to the lecturer was heartily accorded on the motion of Professor Turner, seconded by Mr. Lester.

NOTES AND NOTICES

INSTITUTE ANNUAL GENERAL MEETING.

Notices have already been issued in respect of this event, which is to take place at the Institute on Tuesday, 25th April. Members are asked to return the Nomination and Attendance Forms sent out with the notices at the earliest convenience. The meeting will take place at 11-15 a.m., and luncheon will follow at the Midland Hotel, whilst at 3 o'clock in the afternoon an Exhibition of Yarns and Fabrics will be opened at the Institute premises.

The aim of the Institute in promoting this Exhibition is to secure a collection of newest productions in yarns and fabrics from the various sections of the textile industry, thus providing for interchange of information and ideas. A substantial response has been made to the invitations to exhibit sent out by the Committee of the Institute, and an interesting display is assured. A catalogue of exhibits will be issued.

The Exhibition will remain open from the 25th to the 29th April inclusive, and Members are asked to introduce friends likely to be interested.

A special exhibit will comprise a number of specimens of fabrics containing faults from the standpoint of the finishing branch of the industry, and this exhibit will be specially referred to by Messrs. S. H. Higgins (Bleachers' Association) and A. Hodge (Calico Printers' Association) in their paper to be submitted at 4 p.m. on Friday, the 28th April.

COTTON RESEARCH ASSOCIATION'S LABORATORIES.

The opening of the new laboratories of the British Cotton Industry Research Association at the Shirley Institute, Didsbury, near Manchester, on Tuesday, the 28th March, was an event of unusual importance and significance to the cotton manufacturing interests of this country. H.R.H. The Duke of York, who has already exhibited a definite interest in various movements associated with industry, attended and performed the opening ceremony. For its success, the event depended very largely on the weather conditions, and although the morning opened unpromisingly, yet the conditions were really quite satisfactory. There was, of course, a large and representative gathering, visitors being accommodated in a large marquee. From the attendance point of view, the gathering was extremely interesting, and visitors associated with several branches of the textile industry attended from many parts of the United Kingdom. Mr. Kenneth Lee, as Chairman of the Council of the Cotton Research Association, welcomed the Royal visitor in an utterance in which he covered quite a lot of ground as to the aims of the new institution, pointing out particularly that the foundation of the institution meant the establishing of a link between the industry and science and between the universities and the industry which had not previously existed. In the immediate future, he said, we are likely to witness an international race in research and discovery instead of a race in armaments—a race which Great Britain cannot afford to lose, linked up as it is with the prosperity not only of the cotton trade, but of the whole nation.—The Duke of York performed the opening ceremony, and urged the importance of research from the standpoint of possibilities in the matter of more constant employment to the workpeople of the nation.—Subsequently, the visitors inspected the various departments of the Institute and its laboratories and experimental workshops. The arrangements for the whole ceremony were planned on lines which proved smooth-running and the time-table was well adhered to, the Director (Dr. A. W. Crossley) having personally superintended the organisation of the proceedings.

A "REVOLUTION" IN KNITTED FABRIC.

The publication in a well-known Yorkshire newspaper ot two special articles extolling the merits of a new process of cloth manufacture has aroused a good deal of sceptical interest in the West Riding. The claim is that the cloth, produced by a modified knitting process, is "exactly" like a woven cloth in appearance, and similar in handle; that it has no selvedge; that it cannot be made of mixed materials, but only of an all-wool yarn (this is assumed to be an advantage); and, finally, that a woven cloth costing twenty shillings a yard can be exactly imitated at half the price! The last claim is, of course, absurd; for the total weaving costs of such a cloth, including all overhead charges, can hardly be reckoned at more than a shilling a yard. It is quite possible that the new process may save half the cost of conversion from yarn to pieces, but in an all-wool cloth—and we are told that the process cannot be applied to anything else—that is a small percentage of the total cost of production. We are further told that the new fabric has a good deal of elasticity, particularly in one direction; and the writer of the articles does not seem to be conscious of the fact that at any rate for the men's wear trade this particular form of elasticity is a serious drawback. No trouser-press has yet been invented which will prevent baggy knees in elastic trousers. The whole system of tailoring for men depends on the rigidity of the fabric, without which no garment would retain its shape. For these reasons, manufacturers in the West Riding are not hurrying to send their looms to the broker, though they are decidedly curious about the new process. —F. J. N.

EMPIRE COTTON GROWING MOVEMENT.

It was a wise decision to publish in some permanent form Mr. J. W. McConnel's address prepared for the Empire Cotton-growing meeting. As Chairman of the Administrative Council, Mr. McConnel is closely in touch with the movement for establishing new cotton fields; he is, in fact, at the very heart of the whole business, and his address contained some practical, business-like hints. As, for example, his suggestion that for a beginning they ought to concentrate on four districts—especially for the first few years—those districts being Nigeria, Uganda, Tanganyika, and the Sudan. Equally to the point was his suggestion that there should be six committees, appointed by the Executive, whose work is indicated in the name that he gave them—regional committees. Four of these should be appointed at once, to cover the four districts already alluded to. The two others should act for India in one case, and in the other for Australia and the West Indies and similar places. The work of co-ordinating the duties of these committees and of securing continuity of thought in all the areas was naturally to be left with the director. Generally, Mr. McConnel seems to have outlined a live working plan, and it is well for the furtherance of the movement that this plan should be secured permanency. It will add to the driving power that of necessity will have to be put into the scheme. It is a scheme involving much patient and laborious preparatory work, and some time must elapse before we see big cargoes of cotton coming up to the Manchester docks from these areas, but, if the foundation is well laid and the plans for it are good, that time can be shortened. —R. C.

THE WOOL TEXTILE FINANCE COMPANY.

The scheme for assisting merchants in the wool-textile trade by providing extra credit guarantees has received enough support to justify the promoters in going on with the formation of the Wool Textile Finance Company. Of the £1,000,000 asked for—not in cash but in guarantees—£400,000 has been conditionally promised; a sum which, useful as it undoubtedly will be, is a mere fraction of the need. Yorkshire business men are very strongly individualist in their outlook, and many of those to whom the appeal has been addressed, and who might, perhaps, have been expected to respond, have taken up the attitude that a merchant's credit is the affair of his banker and of the manufacturers who supply him, and that these, between them, should be both able and willing to finance him if that is a sound business proposition. But this attitude takes too little account of the present exceptional position and its causes. When the great slump came, it was the merchant who was "on the top of the concertina." The losses which he had to face included the profits—and they were substantial—of topmakers, spinners, and manufacturers. It is true that concessions were made, and in some cases they were generous, but it remains the fact that the merchant had to bear the heaviest share of the loss. The result is that many old-established firms of good repute have lost almost the whole of their working capital. They have one very valuable asset which cannot be realised or mortgaged—the reputation and experience acquired by long and successful trading, and the organised ability of their managers and servants acting in trained concert. Whether bankers ought to make liberal advances on such insubstantial security is a disputable point. Perhaps the old-fashioned local banks would have done so without much hesitation, but the new multiple-shop banks will not; and that is where the Wool Textile Finance Company comes in. Its promoters believe that the rehabilitation of the great exporting houses is a concern of the whole trade, and accordingly the list of guarantors already published includes such names as those of Mr. Harry Dawson and Lieut.-Col. F. Vernon Willey—gentlemen whose main business interests are at the raw material-end of the industry, and who have little direct concern with the financial position of cloth merchants. The scheme may be described as a pooling of goodwill for the creation of credit. It is a most interesting experiment in trade co-operation. —F. J. N.

THE HUMAN FACTOR IN INDUSTRY.

Mr. W. Harrison may have over-stressed his case when in his recent lecture at the Textile Institute he suggested that the human factor was of more importance in trade than economic laws, but it is a fault that has its virtues. It decidedly emphasises a point to which since the beginning of the industrial era too little attention has been paid. Perhaps a true valuation would be that one factor is of equal value with the other, and unfortunately, so far, we have been too much engrossed with the economic side only. As Mr. Harrison said, it is absurd to think that business is ruled by the economic law only. This law plays its part, and will continue to play its part, but it will never cover the whole field of industrial application as it is developing to-day. What is wanted is a better feeling between the producing and the managerial side. We are recognising that, but we are not preparing for it as speedily as we might do. There is deep-rooted suspicion on each side, and the war and all that has followed the war has done something to foster that unbusiness-like feeling. We see something of the effects in the engineers' lock-out, an event which suggests that all the efforts made towards industrial peace on permanent lines have failed. Not wholly have they failed, of course, but there is need for the education of both sides in the value of closer intercourse and of frank understanding. If this end is to be attained, neither side must make extravagant claims. Efficiency and co-operation are needed; to attain them there must be frank criticism—criticism whose only aim, however, will be to clear away the debris of out-of-date systems. The very core of the new system must be the human factor. Not at all unlikely when this is given full play, it will be found that the economic law factor will operate almost automatically, certainly without interference. —R. C.

TRADE MARKS, PATENTS, AND DESIGNS FEDERATION.

Within the last few months there has been brought into existence an organisation of trade mark owners, its purpose being to obtain a more adequate degree of protection for British trade mark rights in foreign countries and to stamp out, so far as possible, flagrant abuse of British marks. The activities of the new Federation are entirely restricted to work of a public nature, and it has no intention of doing any private work such as is usually undertaken by trade mark and patent agents. The Federation, it is officially stated, acts as the advisers of the Federation of British Industries, with whom it has entered into an agreement for mutual support in matters of common interest, its consultative adviser being Mr. Ralph Griffin, late Registrar of Designs and Trade Marks at the Patent Office. An interesting booklet has been prepared by the Federation dealing with the various problems which confront trade mark owners, and explaining fully the aims and objects which it has before it. The development of the Federation will no doubt be watched with interest by all trade mark owners. Its offices are at 60, Bank Chambers, 329, High Holborn, W.C.1.

GENERAL ITEMS AND REPORTS

RESEARCH IN WOOLLEN AND WORSTED INDUSTRIES.

The annual report of the Council of the British Research Association for the Woollen and Worsted Industries, which has its headquarters at Leeds, states that the development in equipment of the laboratories, library, and experimental workshops now enables the Council to deal extensively with both fundamental and more immediately practical problems. The Council has relegated the bulk of its work to three main committees—Research Control, Education, and Sheep Breeding. Membership of the Association has increased to 466, with a total increase of income of £376, making the annual income £13,732. On the year's working, and in spite of the fact that alterations have been financed out of income, there is only a very small deficit—£130.

A Joint Advisory Education Committee has been created to act as advisor to the Board of Education and to the City and Guilds of London Institute in educational matters touching the woollen and worsted industries. A panel of employers willing to accompany H.M. Inspectors on their visits to textile schools is in process of formation.

The report contains a programme of research work in contemplation, and it is pointed out that a complete study of the matters presented would cover a good many years of work. The subjects embrace Humidity, &c., Testing Machines, Microscopy of the Wool Fibre, Measurement of Fibre, Elastic Properties of Wool Fibre, Scouring Methods, Testing of Fastness of Dyestuffs, Weaving Mechanism, Steam Economy, and Spinning. It is stated that considerable progress has already been made in development of methods for the study of the speed of spindles and the motion of yarn during spinning. A special sub-committee has been formed to inaugurate a thorough investigation of the loom. The building programme of the Woollen Carding and Spinning Committee, under which it is proposed to erect and equip a model factory for large-scale experiments, on a site purchased at Huddersfield, has not yet been proceeded with, and efforts are being made to secure facilities for experimental work on a commercial basis on existing plant in works of members. It is also intended to give lectures and demonstrations to carding overlookers.

REPORT OF DEPARTMENT OF AGRICULTURE, BARBADOES, 1920-21.

Reference is made to the experiments for improving the quality of Sea Island cotton grown in Barbadoes, and favourable reports are given of the native variety of Sea Island cotton which appears to be free from most fungal and insect diseases.

—W. R.

ANNUAL REPORT OF DEPARTMENT OF AGRICULTURE, UGANDA, 1920.

This report deals with the activities of the preceding nine months. Particulars are furnished of the work on the cotton crop and statistics given. The chief diseases of cotton occurring were *Glomerella gossypii*, the grey mildew (*Ramularia areola*), this being accompanied by a *Macrosporium*, which causes discoloured patches on the leaves, a Fusarium which is possibly only a saprophyte, a *Botryodiplodia* responsible for a die-back disease of stems and other diseases previously reported—*Cercosporella gossypii* and *Uredo gossypii*. There are also minor references to flax and native silk.

—W. R.

REPORT OF THE DEPARTMENT OF AGRICULTURE OF BENGAL, 1920-21

During the year 1920-21 the Bengal Department of Agriculture passed from the control of the Revenue Department of the old government to that of the Ministry of Agriculture and Industries under the reformed government. The present report surveys the operations of the department during this transition period and gives detailed and instructive appendices relating to the work carried out at the various centres of work.

The research work on fibres is of especial interest. Of these jute has received most attention and two new strains have been evolved, which are being propagated on a large scale. A systematic investigation of the chlorosis disease of jute and of possible methods of control has been begun and a certain number of manurial tests have been carried out on this crop. Experiments have been carried out on long staple varieties of cotton, but though the experiments are being continued there appears to be little likelihood of cotton growing in Bengal ever becoming a commercial success. The moist climate and the sodden soils of Bengal are unfavourable to this crop.

A considerable section of the report deals with sericulture and a large amount of hybridisation and other research work on both the silkworm and the mulberry is described in detail in one of the appendices.

—W. R.

COTTON CONSUMPTION STATISTICS.

In articles published in this Journal in May and November, 1921, respectively, the writer gave the results of a calculation of the world's cotton consumption, based on the statistics of the International Cotton Federation. To avoid repetition, the tables of statistics given in these articles will be referred to here without reproduction. Since 1921, the Federation have been publishing their statistics of consumption every six months instead of only yearly as before the war; and the appearance of the third half-yearly issue, as at 31st January, 1922, again affords an opportunity of comparing the consumption of the last half-year with that of previous periods, and of estimating how far the cotton industry throughout the world has recovered from the slump of 1920-21. In addition to the reservations noted in the preceding articles, it should be noted that the statistics for Russia are of very doubtful statistical value; but, as they make little alteration in the comparative results, it seems better to leave them in with this caution, rather than to omit them altogether. Statistics for China for the previous periods, which were not published at the time, are now included throughout, so that comparisons can be made without the reservation formerly necessary on that point.

Considering the new statistics in detail, the first point to be noted is that the latest period shows, in almost every country, a very great improvement on the previous half-year. This is especially the case in Great Britain, where the consumption has been almost twice as much as in the period of the coal and cotton strikes. The Continent also shows a considerable increase, which is distributed fairly evenly over the various countries. The increases for the United States, and for the rest of the world generally, are not so striking as those for the United Kingdom, because these sections showed practically no depression for the half-year ending 31st July, 1921, but in most cases a small increase. This improvement has been maintained, most noticeably in the case of the United States. The amounts consumed are, therefore, very considerably larger than those for the half-year ending 31st January, 1921, *i.e.*, the first half-year of the slump. This is also the case to a smaller extent with Great Britain, which is rather better than a year ago. The same is true of most of the Continent (Russia is the most notable exception), so that the world's total consumption is not only better than last half-year, but better even than a year ago.

A more valuable comparison, however, is with the last pre-war season, 1912-13, which affords a standard basis on which the results of all subsequent years may be judged. The percentage on 1913 has therefore been added to the most important results in the table here given. Looked at in this light we see that Great Britain has achieved a rate of annual consumption during the last half-year which is about 64 per cent. of the pre-war consumption. While this compares favourably with recent periods, it is not yet up to the level of the boom year of 1919-20, when the percentage was 82. The Continent, however, shows quite a different position, the consumption for 1919-20 being only 41·6 on 1913, while it was 60·3 for 1920-21 and at the rate of 65·8 for the last half season, showing a steady recovery towards the normal from the very low point of the season 1919-20.

In America, the number of spindles has increased steadily since 1913, and the consumption showed a proportionate increase in 1919-20, from which it fell off the following year, but it has now recovered again to the point of being greater than 1913, though not quite to the extent of 1920, the percentages being about 105 as compared with 112 (see Tables in November, 1921, article). America, therefore, is again approaching the maximum post-war consumption of 1919-20 more quickly than Great Britain or the Continent, except in Egyptian, where this country seems to be recovering more rapidly. This is primarily due to the boom and collapse of the tyre trade in America, to which reference was made in the previous articles.

But the most striking fact of the whole position is that the world's total consumption for the last half-year represents a rate of annual consumption of almost 90% on that of 1913; a rate which has not been equalled since the conclusion of hostilities (nor in all probability during the war, though complete statistics are not

COTTON CONSUMPTION STATISTICS

COUNTRY.	HALF-YEAR to 31st January, 1921.						HALF-YEAR to 31st July, 1921.						HALF-YEAR to 31st January, 1922.					
	Active Spindles	Consumption.					Active Spindles	Consumption.					Active Spindles	Consumption.				
		Amer.	Indian	Egypt.	Sundries	Total		Amer.	Indian	Egypt.	Sundries	Total.		Amer.	Indian	Egypt.	Sundries	Total
Great Britain	56,352	1,091	23	152	46	1,312	56,141	587	16	85	24	712	56,420	1,108	26	168	74	1,375
Percentages on 1913*	**101·3**	**29·7**	**42·6**	**38·8**	**28·6**	**30·7**	**100·9**	**16·0**	**29·6**	**21·7**	**14·9**	**16·7**	**101·4**	**30·2**	**48·2**	**42·8**	**46·0**	**32·2**
Germany	6,561	272	102	9	20	403	7,620	372	103	14	5	494	9,400	442	109	21	11	583
France....	7,000	314	34	25	22	395	7,647	269	35	17	9	331	9,049	349	41	29	15	435
Russia	750	...	....	1	673	674	?			2	250	252	1,100	·5		·5	366	367
Poland and Finland....	1,418	56	6	2	6	70	1,401	69	13	3	5	92	1,425	99	18	1	3	122
Austria	1,140	21	21	1	1	44	1,140	33	16	1	....	50	1,022	45	13	1		59
Czecho-Slovakia	3,584	89	17	2	2	110	3,583	119	26	4	1	150	3,565	167	26	5	2	199
Italy	4,506	302	111	12	4	429	4,506	260	97	8	1	366	4,550	263	102	8	2	375
Spain	1,806	138	34	7	1	180	1,806	86	24	4	3	118	1,806	114	16	4	3	137
Belgium	1,591	70	56	1	1	128	1,548	43	38	1	1	83	1,585	67	51	2	2	122
Switzerland	1,531	29	4	9	...	42	1,531	26	3	11		41	1,550	26	3	13		43
Other European	1,844	121	15	....	33	169	1,803	114	13	2	2	128	1,775	109	13	1	19	144
TOTAL CONTINENT .	31,731	1,412	400	69	763	2,644	32,585	1,391	368	67	277	2,105	36,827	1,681	392	86	424	2,586
Percentages on 1913	**72·4**	**30·4**	**52·0**	**18·0**	**36·6**	**33·6**	**74·3**	**30·0**	**47·9**	**17·6**	**13·3**	**26·7**	**84·4**	**36·2**	**51·0**	**22·6**	**20·3**	**32·9**
U.S.A.	36,051	2,221	5	58	36	2,320	36,478	2,451	6	52	31	2,540	36,843	2,855	6	82	60	3,003
Percentages on 1913	**114·4**	**40·0**		**43·3**	**112·5**	**40·6**	**115·8**	**44·1**		**38·8**	**96·9**	**44·4**	**116·9**	**51·4**		**61·2**	**187·5**	**52·5**
India	6,763	1	1,109	2	2	1,114	6,763	26	1,079	4	20	1,129	6,871	36	1,106	3	20	1,164
Japan	3,804	337	723	7	46	1,113	4,127	285	693	9	22	1,009	4,483	365	694	12	40	1,112
Canada	1,100	78	..	2	....	80	1,100	69	..	....		69	1,051	73	....	1	..	74
Others	2,470	16	68	39	821	944	4,291	63	79	16	694	852	4,612	125	131	20	672	949
TOTAL NON-EUROPEAN	50,188	2,653	1,905	108	905	5,571	52,759	2,894	1,857	81	767	5,599	53,860	3,454	1,937	118	792	6,302
WORLD'S TOTAL	138,271	5,156	2,328	329	1,714	9,527	141,485	4,872	2,241	233	1,068	8,416	147,107	6,243	2,355	372	1,291	10,263
Percentages on 1913	**96·4**	**35·5**	**59·7**	**35·1**	**48·6**	**42·1**	**98·6**	**33·6**	**57·5**	**24·9**	**30·3**	**37·2**	**102·5**	**43·0**	**60·4**	**39·7**	**36·7**	**44·9**

* *i.e.*, on the **twelve** months ending 31st August, 1913, being the last Federation figures before the war. Those for 1913-14 were, of course, never completed.

available). And this, it must be remembered, in face of the reduction of hours in most countries since the war.

The following are the figures for the four periods in question :—

TOTAL WORLD'S CONSUMPTION OF COTTON OF ALL KINDS.

				% on 1913.
Year ending	31st August,	1913	Bales 22,865,000	—
,, ,,	31st July,	1920	,, 18,940,000	82·8
,, ,,	31st July,	1921	,, 17,943,000	78·5
Half-year	31st January,	1922	,, 10,243,000 = an annual rate of	89·8

It is, of course, impossible to say what the remainder of the current half-year may have in store, but, judging by the American consumption in February, which is now known, the New England strike has not yet at least made a very great reduction in the total consumption of the U.S.A. If that remains true for the rest of the season, and if the present improved tendency in Lancashire is maintained, there seems no reason to expect that the world's consumption for the second half of the current season will be very much less than the first. Should that prospect be anything like realised, the world's position with regard to the stock of cotton, especially American, will unquestionably be very serious. It is now abundantly clear, and the Federation statistics of stocks as at 31st January, 1922, were the last item of evidence needed to prove it, that the world's abnormal carry-over of American at 31st July, 1921, has already been very substantially reduced, and there is every reason to believe that by the end of this season it will be back to quite normal proportions. To meet the consumption of the season 1922-23, whatever that may be, the world must therefore look to the 1922 crop. It is obvious that the relations between consumption and production next season will require to be very different from what they have been for the current season, if a serious shortage is to be avoided.

23/3/22. JOHN A. TODD.

REVIEWS

PRODUCTION AND FAIR PROFITS. By James Turner. (Manchester: Sherratt and Hughes. PP.242. Price 6/- net).

This volume, of which the sub-title is "The Key to Industrial Peace," has undoubtedly been written by a man who is thoroughly dissatisfied with the existing industrial system and who is sincerely anxious to find remedies for its defects. Even the crude philosophy, the logical inconsistencies, and the questionable statements of fact it contains, make the volume an attractive one. Briefly stated, the thesis of the author is that self material gain is a first law of nature, and that greed for immediate material gain is the fundamental cause of all social and economic ills. These ills find expression in unreasonable prices, ca' canny service, wars, exchange difficulties, trusts, trade unions, tariff reform, &c., all of which find in the author a vigorous critic. Disregarding any solutions based upon goodwill as not being in accord with human nature, as the author understands it, he looks to the establishment of a system, imposed apparently by legislative enactment, in which checks will be placed upon the unlimited freedom and opportunity to gain which he conceives to be the vital defect of the existing system. As regards industries, it would appear that Mr. Turner would like to see in operation a statutory limitation of profits, combined with a scheme of profit-sharing as between capital and labour, and excess profits over the statutory limit to accrue to the State for the relief of taxation. As regards land, he would have a system of occupational ownership, the occupiers paying an occupational rent to the State. As regards education, "the best thing the Government and Municipalities can do is to hand over the schools at a reasonable rent to the headmasters, to be made self-supporting on the lines of a business concern."

Although the volume is of interest as coming from a man "who began work and earned productive wages at eight years of age" and who claims "to have materially helped the cotton industry," one is afraid that it will not be widely accepted either as offering an adequate analysis or as throwing much new light on the solutions of the problems the author has attempted to grapple with. – G. W. D.

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PROCEEDINGS

TWELFTH ANNUAL GENERAL MEETING

MR. JOHN EMSLEY, J.P. (BRADFORD), ELECTED PRESIDENT

The twelfth Annual General Meeting of the Institute was held at Manchester on the 25th April. Colonel F. R. McConnel presided, and he was supported by the President-elect (Mr. John Emsley, J.P., Bradford), Mr. John F. White (Chairman of Council), Mr. John Crompton (Vice-Chairman), Mr. T. Fletcher Robinson (Hon. Treasurer), Mr. W. Frost (Hon. Secretary), and Mr. J. D. Athey (General Secretary).

In opening the proceedings, the CHAIRMAN made reference to the death of Sir Edward Tootal Broadhurst, and said that by his death the Institute had lost an earnest supporter. His firm had contributed generously to the Institute Foundation Fund, and the members of the Institute felt they had sustained a very great loss.

After the adoption of the minutes of the previous annual meeting, Mr. JOHN F. WHITE moved the adoption of the annual report of the Council. He said he was quite sure that the members would agree that during the past year the Institute had certainly endeavoured to do a considerable amount of good within the industry. Particularly would he like to direct attention to the good work accomplished by the Crompton Prize Scheme, and he would like to see a number of the other branches of the industry follow the example of Mr. John Crompton. Mr. Crompton had set a good lead, and he was sure there were members interested in branches of the industry other than cotton who were capable of following that lead if it was only brought to their notice. The scheme had extended its operations during the past year, and at least two of the important prizes had gone to student prize-winners of the Bradford Technical College. The conference at Basle proved an outstanding success, and the advantages afforded to members in the matter of visits to works were of considerable value. A gentleman well known in the textile industry had referred critically to the reports appearing in a section of the *Journal* as to the social side of the conferences. He (Mr. White) only wished such critics would attend some of the conferences, and they would then appreciate their real educational value.

Mr. JOHN CROMPTON (Manchester) seconded, and said they were all satisfied that the Institute had justified its existence. It would have been unfortunate if there had not been such an Institute at the time of the World Cotton Conference last year. The Institute had recently taken steps to secure greater co-operation between the various Textile Societies and the Institute in order that the Institute might be of greater value to the societies established in different parts of the country. He was hoping that the Institute would get into still closer touch with the large organisations representing the employers and employed, so that matters which affected the whole industry might be frankly discussed. With regard to the scheme associated with his name, he would like to see it enlarged, so that it would take in not only the cotton industry but the woollen and worsted and the Leicester and Nottingham industries. There was ample room, and he believed the existing scheme was doing a great amount of good.

The report, as adopted, was as follows:—

COUNCIL'S ANNUAL REPORT.

In presenting the 12th Annual Report, together with balance-sheet and revenue account for 1921, it is a matter of the utmost satisfaction to be able to record that, despite the difficulty of the period under review, progress in regard to many activities of the Institute has been not only maintained but considerably advanced.

CONFERENCE AT BASLE, SWITZERLAND.—The most notable event of the past year was the holding of the Conference during Whit-week at Basle, Switzerland. The proceedings were of outstanding importance, and the fact that the banquet was attended by the President of Swiss Confederation, the British Minister at Berne, and the Swiss Minister in London, was high tribute to the growing recognition of the importance of the Institute movement for the promotion of greater interest in the technical and scientific aspects of the textile industry. The bringing together of representatives of the various sections of the industry and visits to works in various centres have resulted in valuable interchange of information and experience. With regard to facilities for inspection of works, the proprietors of many large industrial establishments in Switzerland exercised a commendable spirit of magnanimity. The Basle Conference was a distinctly successful fixture from every standpoint, and in order to give permanent expression to our keen sense of appreciation of the hospitality extended and of the excellence of the arrangements carried out by the Basle Chamber of Commerce in association with leading Swiss textile organisations, a piece of silverware, suitably inscribed, was subsequently presented by the Institute to the Chamber named.

AUTUMN CONFERENCE: ANNUAL MATHER LECTURE.—The 1921 Autumn Conference was held at Manchester and was notable for the delivery of the Annual Mather Lecture of the Institute. This special annual lecture was instituted as a result of the scheme of development framed in connection with the effort to create a substantial endowment fund—the Institute Foundation Fund—which would provide means for the pursuit of special objects. There can be no doubt that the promotion of the Mather Lecture has so far been fully justified. In the matter of selection, the Council consider that a really useful purpose was served by the 1921 Lecture, the invitation being given to the Rt. Hon. J. R. Clynes, M.P., who contributed a timely utterance on "Industrial Relationships." It is hoped that this annual lecture may help materially in the raising of the standard of the Institute lectures generally, and the short list of Mather Lectures now on record is eminently satisfactory. In the matter of selection, however, each year—both as to subject and author—it is felt that greater co-operation is most desirable. The Council, therefore, heartily invites suggestions from members of the Institute, many of whom, no doubt, are particularly able to offer useful proposals.

FOUNDATION FUND.—The Foundation Fund, the annual revenue from the investment of which has admitted of considerable extension of the Institute's efforts, now stands at £11,352 6s. 0d., and the income from investment last year was £569 15s. 0d. Although the Fund has made but little progress of late—doubtless largely owing to prevailing conditions of trade depression—yet on the part of those most prominently associated with the Institute movement the desire for the advancement of the Fund continues to find expression by way of actual donations. During the past year, Mr. Oscar S. Hall, of Bury, a member of Council, contributed £100 to the Fund—a donation which was supplementary to a gift of £100 given previously by the firm of Messrs. Robert Hall & Son (Bury), Ltd.

WORLD COTTON CONGRESS: EXHIBITION.—An exhibition of special interest to textile manufacturers was organised and conducted at the Institute premises in June last in connection with the visit of delegates to the World Cotton Congress in Manchester. The object was to indicate to the visitors some of the more recent developments in regard to cotton manufacture, and the exhibits comprised yarns and fabrics of special interest. Open to delegates on three days, the exhibition was also open to manufacturers and others on one day, when over 1,000 persons attended. The display proved of distinctive interest, and it was agreed that the whole effort presented a somewhat new departure in regard to collections of exhibits of textile interest. It has been decided, therefore, to hold an exhibition on similar lines, but covering a wider field as to fibres employed, and the 1922 exhibition will take place at the Institute premises in Manchester from the 25th April to the 29th April inclusive.

DESIGN AND STRUCTURE OF FABRICS: CROMPTON PRIZE SCHEME.—The Institute's Crompton Prize Scheme, under which a sum of £100 is annually offered in prizes for competition on the part of advanced students in design and structure of textile fabrics, has completed its second year of experience. It has been generally conceded that the productions of the competitors in the 1920-21 competition showed considerable advance on the exhibits of the previous year, whilst the number of competitors reached fifteen, as against ten previously. The chief prize-winning albums are available for inspection by members at the Institute, and in several instances, by request, the albums have been transferred for brief periods to textile colleges or schools for display to students. The adjudication in regard to the competitive albums imposes a formidable task on the members of the Committee who serve as adjudicators, and the Council appreciates the fact that the work is performed with great thoroughness. In this connection, thanks are also due to representatives of various interests called in to assist, thereby bringing together the judgment of representatives on the side of manufacture, art and selling. Another important duty which the Crompton Scheme Committee continues to perform is that of adjudicating upon the respective merits of the albums of the Lancashire County Council competition which is open to less advanced students.

THE JOURNAL OF THE INSTITUTE.—The publication of the *Journal* of the Institute is now our largest undertaking from the financial standpoint, and still further development is in progress. To conform to the size adopted in connection with publications of Research Associations, the size of the *Journal*, beginning with the January issue, 1922, was reduced. In addition to the Abstracts section, a section has been added under the heading of "Transactions," which is intended to embrace scientific communications from textile Research Associations and from the scientific departments of individual firms. Already several important communications have been published under joint arrangement as to availability of type and illustrations for printing in pamphlet form. The Cotton, the Woollen and Worsted, and the Linen Research Associations have continued their financial assistance in regard to the Abstracts Section of the *Journal*, which has been greatly developed. The conditions of contribution have been modified in one instance, however, and though the Council of the Institute is most anxious that the work of abstracting, which has been greatly extended, should be fully maintained, yet the financial burden is considerable. Various suggestions have been advanced on the whole subject, however, and it is confidently hoped that in due course joint arrangements satisfactory to all concerned may be effected.

INQUIRIES SERVICE. As an inquiry office in regard to matters of textile interest, the Institute gives an increasing measure of service both to members and to general inquirers, whilst organisations both in this country and abroad submit many demands for information. In all cases no effort is spared to secure completeness of answer. The range of inquiries covers a wide field. Of late, quite a considerable number of inquiries have related to location of productions of yarns or fabrics—fabrics both as to structure and finish—of a more or less exceptional character or quality, and the General Secretary reports that he has received valuable assistance from many members of the Institute in the matter of furnishing really useful information by way of reply.

THE INSTITUTE ROOMS.—Of late the Institute rooms have been brought into extended service for meetings of various textile bodies, whilst the Members' room is used with far greater freedom than hitherto. The facilities offered to members in regard to telephone, correspondence and dispatch of letters, accommodation for interviewing, etc., are now of considerable value, and cafe service is available on Tuesdays, Wednesdays and Fridays.

SECTIONS AND LECTURES.—The lecture arrangements of the various sections of the Institute have been well maintained, and the Lancashire and the Yorkshire Sections each issue an attractive syllabus for the 1921-22 session.

MEMBERSHIP.—The membership roll at the end of 1921—to be carried forward to 1922—was made up as follows:—Honorary Members, 24; Life Members, 19; Ordinary Members, 846; Junior Members, 12; Non-subscribing Members, 2; Non-member Annual Subscriber, 1—total 904.

The totals for the foundation year (1910) and the years 1918 to 1921 were:—1910, 233; 1918, 612; 1919, 724; 1920, 856; 1921, 904.

The Council lament the loss by death during 1921 of the following members:—Sir Alfred W. W. Dale (Liverpool), F. Gardiner (Belfast), H. Jowett (Bradford), C. H. Turner (Rochdale), and J. Wallace (Bombay).

COUNCIL AND COMMITTEE MEETINGS:—Council, 5; Finance and General Purposes, 11; Publications, 6; Crompton Prize Fund, 6; Research and Inventions, 6; Yorkshire Section Committee, 7; Lancashire Section Committee, 6; So. of Scotland Section Committee, 2—total 49.

In addition to the foregoing, several sub-committees met for the consideration of special matters. The corresponding total number of meetings in 1921 was 44.

SECTION MEETINGS.—Eight meetings of the Lancashire Section, ten of the Yorkshire Section, and four of the South of Scotland Section were held, and important papers were read and discussed.

HON. TREASURER'S REPORT.

Mr. T. Fletcher Robinson, Hon. Treasurer, presented his annual financial report, as follows:—

I have pleasure in presenting the treasurer's report for the year ending 31st December, 1921:—

FOUNDATION FUND.—This fund received during the year £100 from Mr. Oscar S. Hall, making the total £11,352 6s. 0d., made up of £9,218 8s. 0d. paid for £9,655 War Stock and Funding Loan, £2,000 Lieut. Crompton Memorial Fund, and £133 18s. 0d. in the bank.

JOURNAL.—The year 1921 gave a full year's experience of the *Journal* under the new arrangement with an Abstracts Editor, and an analysis of the accounts shows:—

Total cost of *Journal* for 1921, £2,897 12s. 5d.; receipts from sales and advertisements, £1,373 16s. 7d.; gross deficit, £1,523 15s. 10d. The deficit was met as follows:—Research Associations £800, Clothworkers' Company £10 10s., from Institute funds £713 5s. 10d.=£1,523 15s. 10d. The amount devoted to *Journal* from Institute funds in 1920 was £583 8s. 4d. There was an increased expenditure during 1921, above 1920, for:—Printing £92 11s. 9d., contributors and abstractors £93 9s. 7d., and editorial remuneration £239 3s. 4d.=£425 4s. 8d., against which there was an increased income from advertisements, &c., of £263 12s. 2d.

The alterations in the *Journal* for 1922 I estimate will mean a further increased expenditure of £240 for printing and £80 cost of reprints of abstracts for the Wool Research Association; further, there promises to be less income from advertisements. This would mean about £1,100 deficit to be found by the Institute for 1922 (after receiving again the £800 from the three Research Associations) as against the deficit for 1921 of £713 5s. 10d.

REVENUE ACCOUNT.—Included in the expenditure is £192 11s. 4d. for the Basle Conference, £35 16s. 6d. medal account, £77 4s. 6d. for Exhibition expenses, and £104 7s. 3d. expenses of sections. On Revenue Account there is a deficit on the year (after crediting the balance of the income from Foundation Fund of £410 10s. 8d.) of £155 18s. 11d., against a surplus over expenditure in 1920 of £302 18s. 1d. Receipts from members' subscriptions have been:—

1915.	1917.	1919.	1920.	1921.
£619 10 0	£851 2 6	£1,394 5 5	£1,567 1 9	£1,631 14 0

The arrears of subscriptions at end of 1921 were £109 4s. 0d. more than 1920, the number of members at end 1921 being 904, as against 856 end 1920.

Expenditure on rent and salaries has been as follows:—

Rent, Rates, Heating and Cleaning.

1913.	1918.	1920.	1921.
£114 9 2	£219 3 11	£221 9 5	£282 9 7

Salaries of Staff.

1913.	1918.	1919.	1920.	1921.
£156 10 0	£453 12 6	£751 15 0	£1,144 0 0	£1,436 8 4

The cost of meetings, travelling, printing and stationery has been £125 12s. 1d. more.

Members of the Council and of the Institute will see from this statement that, despite the serious economic depression, there has been an increase in membership of 48. With the personal interest of members there is every opportunity for a much greater increase, and along this line the financial position of the Institute can be most satisfactorily strengthened. It is also satisfactory to note that the Council and the Publications Committee have in mind the serious consideration of how the expenditure on the *Journal* may be satisfactorily reduced without injuring its standard of efficiency.

Mr. W. **Frost** (Macclesfield), in moving the adoption of the Treasurer's Report, Balance-Sheet and Accounts, and the Auditors' Report, said that, speaking as Chairman of the Finance and General Purposes Committee, they found they were limited in their usefulness by the amount of money they had at their disposal, and they also found that they had ample use for any money the members might entrust to them. The Foundation Fund was not making much progress, but they sincerely hoped it would be considerably augmented during the next year or two. It was only as they could get the fund increased that they could feel the security of having a definite income which they could apply in various ways. The special Crompton Fund had been instrumental in doing an immense amount of good in developing taste and ability amongst designers and clothmakers throughout the country. The greater the income of the Institute, the better able were they to do the work they had set themselves to do for the benefit of the textile industry. Therefore, he appealed to all those who were in the happy position of having any money at the present time to remember the Foundation Fund, in order that the Institute might be able to increase its usefulness.

Mr. F. **Nasmith** seconded, and said he had been going into the figures of the overhead charges of the *Journal*. He did not wish to see, nor did he think any members of the Institute would wish to see, the *Journal* reduced in shape or form, yet he felt they ought to consider carefully the matter of overhead charges. They were told that a deficit of £1,100 was anticipated for the current year, and it appeared to him that they would either have to increase the membership or reduce the expenditure. The *Journal*, on the existing basis, was a tremendous burden to carry, and it was preventing the Institute from doing good work in other spheres.

Mr. J. H. **Lester** (Manchester) said with regard to the suggestion made that the expenditure upon the *Journal* had been too heavy and would require curtailment, he would point out that the *Journal* was not to be regarded as a trade publication. Scientific journals could not be run on anything like the charges of trade journals. The overhead charges, when compared with the overhead charges of similar journals, were not excessive, and although there was something to be said for economy there was something to be said on the other side.

The reports were adopted, the balance-sheet and accounts being as printed on pp. 78—83.

ELECTION OF PRESIDENT.

Colonel F. R. **McConnel**, the retiring President, proposed the election of Mr. John Emsley, J.P., of Bradford, as President for the ensuing year. Speaking after his own experience, he was sure Mr. Emsley was undertaking a task of singular pleasure. He could promise Mr. Emsley the same amount of whole-hearted support that had been given to him. Everyone had done their best to make his task light, and he looked forward with the greatest confidence to Mr. Emsley receiving the same support from officials, members of Council and committees, and members generally. He personally would be delighted to help him. The Institute had had a line of distinguished presidents, and each one had helped forward the work the Institute had undertaken. He was quite sure that in Mr. Emsley they had a gentleman who would do his part. The growth of the Institute from its foundation had been steady, and it had grown from small beginnings until to-day it was in a healthy position. The financial position had been referred to in a rather gloomy way, but it was necessary that they should face facts, and he thought they must look forward to a brighter and more vigorous life under the wing of the new President. He had great pleasure in proposing Mr. Emsley's election.

Mr. **John F. White** (Bradford) seconded, and said it gave him added pleasure because Mr. Emsley came from the same city as himself, and he had knowledge of the energy he put into the affairs of the city of Bradford. During the past year the Institute membership had slightly increased, but they wanted a much stronger membership in order that they might strengthen the whole position. The Institute had arrived at a stage when it wanted more energetic work from every member of the Council and every member. The membership must be increased, and every member could help in that direction. When they considered the magnitude of the textile industry at the present time, they must realise that they had only a very small part represented in membership. There was something lacking somewhere, and he thought it was possible that members were not taking that interest in building up the Institute which they ought to do. In electing Mr. Emsley, he was sure that, through him, they would get that energy which was slightly lacking at the moment.

Mr. Emsley was unanimously elected, and he assumed the chair vacated by Col. McConnel.

PRESIDENTIAL ADDRESS.

Returning thanks for his election, Mr. Emsley said:—

Gentlemen, I thank you very sincerely for the great honour you have done me. I recognise that I have to follow a line of most capable gentlemen, who have made life-long studies of great businesses and have had to solve problems that are only put to men of their experience. I am deeply conscious of this fact, but I hope during my term of office to uphold the dignity of the position and to strive to pass on to my successor a stronger and more efficient Institute, if that is possible.

The name " Textile Institute " is one that embraces everything that applies to any textile—cotton, wool, silk, flax, or any other fibre, natural or artificial, used in the textile trade. There are Textile Societies in many places in Lancashire and Yorkshire, and as time goes on they will, I hope, become more and more affiliated with this Institute as a parent body. It is most essential that we should work together as one body, so as to save overlapping, and utilise brains and finances to the best advantage.

We must have a raw material to begin with in every case. In this country we have a very limited quantity of home-grown material, and must go far afield to get our supplies, and we shall have to take a great deal more interest in the

Dr.

The Textile Institute. Balance Sheet

1920. £ s. d.	LIABILITIES.	£ s. d.	£ s. d.
	Subscriptions paid in advance as per list—		
	18 Members @ £2 2s. 0d. each	37 16 0	
	4 Members @ £1 1s. 0d. each	4 4 0	
52 10 0			42 0 0
	Life Members' Subscription Account—		
	Balance at 31st December, 1920	101 1 3	
	Subscriptions received during 1921	46 0 0	
		147 1 3	
	Less Amount carried to Revenue Account 10% on £382 8s. 0d. (Gross Receipts to date) ...	38 4 9	
101 1 3			108 16 6
	Foundation Fund—		
	Balance at 31st December, 1920	9252 6 0	
	Donations received during year	100 0 0	
9252 6 0			9352 6 0
2500 0 0	Crompton Prize Fund Account		2500 0 0
47 10 0	Life Membership Special Reserve Account		47 10 0
	Crompton Prize Fund Scheme – Income and Expenditure Account		22 9 4
400 0 0	*Journal* Account—Reserve to 1922		400 0 0
	Revenue Account—		
	Surplus at 31st December, 1920	611 14 7	
	Less Deficit for the year to 31st Dec., 1921	155 18 11	
611 14 7			455 15 8
£12965 1 10			£12928 17 6

T. FLETCHER ROBINSON, *Hon. Treasurer.*
WM. FROST, *Chairman of Finance Committee.*

as at 31st December, 1921. Cr.

1920. £ s. d.	ASSETS.	£ s. d.	£ s. d.
	Cash at National Provincial and Union Bank of E., Ltd.—		
530 4 0	General Account	57 9 0	
296 6 6	Foundation Account	133 18 0	
			191 7 0
	Cash in hand		0 1 10
	Reserve: Yorkshire Section Expenses	25 5 1	
	So. of Scotland ,,	5 6 7	
			30 11 8
	Woollen and Worsted Research Association: (Grant unpaid; since paid)		300 0 0
3 10 0	Deposit on Electricity		3 10 0
	Reserve: Heating Apparatus Account		30 0 0
	Furniture Account as at 31st December, 1920	311 4 8	
	Additions during year	127 16 6	
		439 1 2	
	Less Depreciation 10% on £901 13s. 6d.	90 3 4	
311 4 8			348 17 10
	Life Membership Capital Investment Account:		
47 10 0	£50 Five Per Cent. War Loan, 1929-47		47 10 0
	Crompton Prize Fund Capital Investment Account:—		
	£1000 Five Per Cent. War Stock, 1929-47	1000 0 0	
	£1500 Three Per Cent. L. & Y. Rly. Stock	1500 0 0	
2500 0 0			2500 0 0
	Journal Account:—		
303 0 4	Sundry Advertisers' Outstanding Accounts		258 11 2
	Foundation Fund Capital Investment Account:		
	£600 5% War Loan, 1929-47, @ 94½, plus brokerage	567 17 0	
	£5 Tank do. 1922	5 0 0	
	£300 5% do. 1929-47	280 3 6	
	£1000 5% War Stock, 1927	1000 0 0	
	£2000 do. do. 1928	2000 0 0	
	£2000 do. Bonds 1928	2000 0 0	
	£550 do. Stock, 1928	550 0 0	
	£1500 do. do. 1929-47	1413 18 0	
	£1000 4% Funding Loan, 1960-90	800 0 0	
	£400 5% War Stock, 1929-47	339 1 0	
	£300 do. do. 1929-47	262 8 6	
8955 19 6			9218 8 0
£12965 1 10			£12928 17 6

AUDITORS' REPORT TO THE MEMBERS.

We report to the Members that we have examined the above balance sheet, together with the books and vouchers of the Institute, and that we have obtained all the information and explanations we have required. We further report that in our opinion the balance sheet is properly drawn up so as to exhibit a true and correct view of the state of the Institute's affairs according to the best of our information and the explanations given to us, and as shown by the books of the Institute.

ARTHUR E. PIGGOTT, SON & CO., *Incorporated Accountants, Auditors.*

56, Mosley Street, Manchester, *7th March,* 1922.

Dr. **The Textile Institute.** **Revenue Account**

1920. £ s. d.	EXPENDITURE.	£ s. d.	£ s. d.
	To Rent, Rates and Taxes	240 13 11	
	,, Proportion to *Journal* Account	85 13 0	
101 13 5			155 0 11
	,, Secretarial and Editorial Remuneration	1239 3 4	
	,, Proportion to *Journal* Account	832 1 8	
		407 1 8	
	Less amount received from Ring Yarn Association	20 0 0	
339 11 8			387 1 8
	,, Office Wages	217 5 0	
	Proportion to *Journal* Account	108 12 6	
105 15 0			108 12 6
44 6 0	,, Office Expenses:— Heating, Lighting, Cleaning, &c.		41 15 8
52 2 3	,, Sundries – Rooms, Canteen, Attendant, Utensils, &c.		66 17 4
18 11 7	,, Repairs, Alterations, &c.		12 8 2
	,, Painting and Decorating		17 5 0
36 19 2	,, Travelling Expenses		96 15 0
87 9 0	,, Meetings Expenses (and Exhibition)		200 1 3
73 8 4	,, Postages, Telegrams, and Telephone		63 11 8
160 11 4	,, Printing and Stationery		190 19 10
4 2 8	,, Insurance		4 2 8
14 15 3	,, Audit Fee		14 15 0
	,, Subscription: Institute of Industrial Art		2 2 0
	,, Medal Account		35 16 6
77 7 8	,, Depreciation, Furniture Account		90 3 4
	,, Lancashire Section Expenses:— Amount Expended	39 19 3	
	(*Available grant £62 4s. 0d.)		39 19 3
	,, Yorkshire Section Expenses:— Amount Expended	71 14 1	
	*Available grant £46 9s. 0d.	46 9 0	46 9 0
	Balance transferred to Dr. 1922 A/c.	25 5 1	
	,, So. of Scotland Section Expenses:— Amount Expended	23 5 7	
	*Available grant £17 19s. 0d.	17 19 0	17 19 0
	Balance transferred to Dr. 1922 A/c.	5 6 7	
583 8 4	,, Deficit on *Journal* Account		292 4 10
Surplus 302 18 1	[*Sections are entitled to an allowance towards Sectional Expenses of 3/- per Member, plus a Block Grant of £10.]		
£2002 19 9			£1884 0 7

T. FLETCHER ROBINSON, *Hon. Treasurer.*
WM. FROST, *Chairman of Finance Committee.*

for the Year ended 31st December, 1921. Cr.

1920. £ s. d.	INCOME	£ s. d.	£ s. d.
	By Subscriptions:		
33 6 9	Life Members' Subscriptions, 10% on £382 8s. 0d. (Gross Receipts to date)		38 4 9
96 8 0	,, Subscriptions (1920 Account) paid in advance as per Balance Sheet, 31st December, 1920		52 10 0
	,, Subscriptions:—		
	726 Members @ £2 2s. 0d. each ...	1524 12 0	
	17 Members @ £1 1s. 0d. each, half-year	17 17 0	
	13 Junior Members @ £1 1s. 0d. each	13 13 0	
		1556 2 0	
	Special Subscriptions, Weavers' Co. .	21 0 0	
	Yorks. Mill Managers' Association . . .	17 17 0	
	(Subscriptions paid in advance for 1922 not included. See Balance Sheet)	1594 19 0	
	Less 25% of Total Subscriptions to *Journal* Account	421 1 0	
1385 18 0			1173 18 0
			1264 12 9
51 9 0	,, Arrears of Subscriptions		36 15 0
	,, Arrears as per Balance Sheet Memo., 1920	99 15 0	
	Less Amount of Arrears paid in 1921 . . .	36 15 0	
		63 0 0	
	Less Amount of Arrears written off . .	27 6 0	
	Arrears previous to 1921	35 14 0	
	Add Amount of Arrears 1921 Account .	173 5 0	
		208 19 0	
22 13 0	,, Bank Interest (*less* Commission)		16 3 3
413 5 0	,, Transfer from Foundation Fund—Income from Investments Account		410 10 8
	,, Deficit of Expenditure on Income		155 18 11
£2002 19 9			£1884 0 7

ARTHUR E. PIGGOTT, SON & CO.,
Incorporated Accountants, Auditors, 7th March, 1922.

Dr. The Textile Institute. Journal Account

1920.			EXPENDITURE.			
£	s.	d.		£	s.	d.
			To Outstanding Advert. A/cs. brought forward	303	0	4
1110	18	2	,, Printing and Posting	1203	9	11
76	1	5	,, Literary Contributors	68	13	5
137	13	6	,, and Abstractors	238	11	1
			,, Reprints	1	3	0
592	18	4	,, Editorial Remuneration:—			
			Abstracts Editor	425	0	0
			Secretary and Assistant Secretary	407	1	8
105	15	0	,, Wages	108	12	6
21	1	0	,, Postages	23	16	6
34	5	4	,, Purchase of *Journals*, Advertising, Reporting and General Expenses	32	11	0
75	10	0	,, Rent, &c.	85	13	0
37	10	0	,, Typewriter			
400	0	0	,, Amount of Subscription from Research Associations, c/d	400	0	0
£2591	12	9		£3297	12	5
1922. Jan. 1st.			To Outstanding Advertising Accounts	258	11	2

Dr. The Textile Institute. Crompton Prize Fund.

1920.			EXPENDITURE.			
£	s.	d.		£	s.	d.
			To Balance b/d	17	6	10
58	15	6	,, Printing and Stationery	30	4	3
44	14	9	,, Purchase of Specimens	40	0	10
14	7	6	,, Mounting of Specimens	7	6	8
1	17	6	,, Postages	4	13	8
4	10	3	,, Adjudication Expenses	2	15	2
85	0	0	,, Prize Awards and Expenses	160	0	3
			,, Sectional Book Case	4	10	0
			,, Balance c/d	22	9	4
£209	5	6		£235	7	0

Dr. The Textile Institute. Foundation Fund. for the Year ended

1921.	EXPENDITURE.	£	s.	d.
Feb. 25—	To Grant to Inventor	25	0	0
Oct. 7—	,, Institute Medal	2	14	4
,, 12	,, "Mather" Lecture, 1921	25	0	0
	,, Balance transferred to Revenue Account	410	10	8
		£463	5	0

T. FLETCHER ROBINSON, *Hon. Treasurer.*
WM. FROST, *Chairman of Finance Committee.*

for the Year ended 31st December, 1921.

Cr.

1920. £	s.	d.	INCOME.	£	s.	d.
			By Amount b d	400	0	0
			,, Subscriptions:—			
10	10	0	Worshipful Company of Clothworkers	10	10	0
37	10	0	Department of Scientific and Industrial Research			
			Cotton Research Association	300	0	0
800	0	0	Linen Research Association	200	0	0
			Woollen and Worsted Research Association (outstanding, since paid.)	300	0	0
807	4	1	,, Sales and Advertising	1115	5	5
303	0	4	,, Outstanding Advert. Accounts	258	11	2
			,, Transfer of 25% Total Subscriptions	421	1	0
50	0	0	,, Amount transferred from Index Reserve A c.			
583	8	4	,, Balance deficit to Revenue Account	292	4	10
£2591	12	9		£3297	12	5
1922.						
Jan. 1st.			By Amount b d.	400	0	0

Income and Expenditure Account.

Cr.

1920. £	s.	d.	INCOME.	£	s.	d.
8	16	8	By Balance b d			
98	2	0	,, Subscriptions:—			
			Bolton Education Committee	10	10	0
			Blackburn Education Committee	5	5	0
			Bradford Education Committee	5	5	0
			Burnley Education Committee	5	5	0
			Manchester Education Committee	10	10	0
			Leeds University	15	0	0
			Lancashire County Council	75	0	0
			Glasgow Royal Technical College	2	2	0
81	10	0	,, Dividends on 5% War Stock	50	0	0
			L. & Y. Stock, *less* Tax	31	10	0
3	10	0	,, 19 Entrance Fees	4	15	0
			,, Refund of Income Tax	20	5	0
17	6	10	,, Balance c d			
£209	5	6		£235	7	0
1922.						
Jan. 1st			To Balance b d	22	9	4

Income from Investments Account 31st December, 1921

Cr.

1921.		INCOME.	£	s.	d.
Mar.	1 —	By 5% War Stock	113	15	0
April	1 —	,, 5% War Bond (Tank)	0	2	6
May	1 —	,, Funding Loan	14	0	0
June	1 —	,, 5% War Stock	86	5	0
,,	—	,, ,, ,,	10	0	0
,,	—	,, ,, ,,	7	10	0
Sept.	1 —	,, ,, ,,	113	15	0
Oct.	1 —	,, ,, ,, (Tank)	0	2	6
Nov.	1 —	,, Funding Loan	14	0	0
Dec.	1 —	,, 5% War Stock	86	5	0
,,	—	,, ,, ,,	10	0	0
,,	—	,, ,, ,,	7	10	0
			£463	5	0

ARTHUR E. PIGGOTT, SON & CO.,
Incorporated Accountants, Auditors, 7th March, 1922.

foreign countries from which we draw those supplies. World problems are now arising in regard to the supply of these raw materials. In cotton, wool, silk, flax, and in jute we find that we have great problems to solve, not only in regard to new supplies but also in fighting the various diseases that are threatening present supplies. If we are to keep our position, our Institute must take a lead and help to solve them. This can only be done in one way, and that is by research, and for this research we must have trained and educated staffs.

And this brings me to what, in my opinion, is the great question of the day—education. The raw material of education is the child. The maker-up of this raw material is the teacher. If the teacher spoils the material when it is in his hands it is a dead loss to the country. We must get a competent teacher to begin with. But a competent teacher is no use if he has not got his heart in his work, and I am afraid that at the present day our raw material is not being used, as we would like to see it, to the best advantage. We must get teachers with a scientific bent of mind, who can give to the child the ideas that in later life may be developed and applied to the position in life in which it finds itself. The necessities of the great war proved that we in this country have the brains, and it only requires the stimulus to develop them. We must give to all a chance of using their ability. The employing class require education quite as much as the person employed. If we are not giving of our best, or are in any way not taking advantage of scientific knowledge, we are not only doing an injustice to ourselves but to those we employ. As employers, we are responsible for taking advantage of everything that is offered to reduce mere physical labour and to get as near perfection as possible to enable the worker to use his brains instead of his hands. In research, we have many phases to work at. We have to get our raw material grown most economically to obtain the best results; to let our engineers invent machinery to work that material; and to educate people to use the material and the machine. But of the three things, the human element is the one we ought and must take most into consideration. We must all realise that employers have a responsibility in employing labour—to see that everything possible is done to make the conditions under which work is performed as healthy as possible, and to try to break the monotony of work. We can do this by making our factories and workshops bright and pleasant, and here science has helped and is going to help a great deal. We want a more scientific system of ventilation, good sanitation, good lighting and heating—in fact, we must by example in our places of business make the operative feel that it is a pleasure to work. By our efforts in this direction we can make our workpeople appreciate the benefits they derive in health, and if they carry these principles into their homes we shall accomplish more than all the social reforms introduced during the last hundred years. Care for the health of the worker is a proposition that even financially—to put it on the lowest level—offers gain. Personally, I have conducted experiments, and found them a splendid success. I have engaged a dentist to go round my factories and to give advice, and have been astonished at the results. I am convinced that a great deal of the time broken by ill-health is directly attributable to poisoning by faulty teeth. Our loss from broken time is now considerably less than it was.

Again, we found that we were subject to loss from spoiled work. There are always a certain number of workers not so good as the average, and I have made effort to find out the reason. Ill-health contributed, but I was not satisfied that the best work was yet being produced, and so I engaged the best oculist I could procure and told him to examine the eyes of the workers. The results were astonishing. It had got to be a common idea that a worker in a textile factory who wore glasses would be dismissed, and the result was that great numbers of them worked with very imperfect sight. In consequence, we got imperfect work. By persuasion, we got the employees to understand the benefits of improved sight, and our work has increased both in quality and quantity.

Capital is no use laid dead, and it is only by expending it that we get results. We must have in conjunction with capital an active commercial and scientific staff, alive to all the changes that science can give us, and a trained, contented body of producers. At the present time we are faced with many problems on the producing side, and we have had many theories advanced as to how we should meet them. I hope scientific investigation will help to solve the problems. In my humble opinion, the first consideration is the worker, who must be recompensed for his labour, and I am personally a great believer in a bonus on production. I have tried it with most satisfactory results in certain directions, and I hope to continue the experiments. I am not intending to get increased production by driving, but by leading.

I know that we have a great task before us, that all the nations of the world are still suffering from the great upheaval, that they are all trying to solve their problems in their own way. Some are trying to keep their people from buying manufactured goods from others by putting up high tariffs, but the old saying still holds good—"He who will not buy neither shall he sell." I am an optimist in regard to our country, and am convinced that by hard work, hard thinking, and by utilising our splendid human material to the best advantage we shall surmount all our difficulties, and if we are temporarily under a cloud we shall again come to the top not only as the premier producing nation but as the one in which the worker is able to live the most contented and happy life.

It is difficult in these days of change to make any definite pronouncement about trade, but speaking of the branch of the trade of which I know most, that is the manufacturing of worsted goods for men's and ladies' wear, I am convinced that we have seen the worst and that things from now onward are going to improve steadily. Finance is easier, stocks are being absorbed, and we are slowly settling down into more ordinary conditions. In my opinion, the year 1923 will be more a normal year than any year since 1913. The raw material market has found its feet again, and that is a hopeful sign.

Mr. W. GREENWOOD, M.P., moved a vote of thanks to the retiring president, and said it was certain that Colonel McConnel had established his place in a line of distinguished presidents. He felt that none of the members had any regrets that one of the Institute's own people had been appointed as president. They had not had to bring lustre to the Institute from outside—they had got it from within. He hoped Colonel McConnel would accept their sincere thanks.

Mr. GEO. L. CRAIG (Huddersfield) seconded, Mr. F. H. ROBY (Manchester) supported, and the vote was enthusiastically accorded.

Colonel MCCONNEL, in reply, said the thanks were unnecessary. The pleasure had been his own. To his mind there was not a greater honour connected with the textile industry. He thanked them for the kind words that had been uttered and for the support accorded him during his term of office.

ELECTION OF VICE-PRESIDENTS.

Mr. George L. Craig (Huddersfield) and Mr. W. Jaffe (Belfast) were re-elected and Mr. W. Greenwood, M.P. (Oldham) elected as Vice-Presidents.

ELECTION OF COUNCIL.

The General Secretary reported that as a result of the ballot the whole of the retiring members of Council were re-elected. The Council, at its meeting that morning, had elected Mr. William Howarth (Bolton and Manchester) to fill the vacancy created by the elevation of Mr. Greenwood, M.P.

AUDITORS.

Messrs. Arthur E. Piggott, Son and Co. (Manchester) were re-appointed Auditors, subject to agreement with the Finance and General Purposes Committee as to fee.

LUNCHEON.

After the annual meeting luncheon was provided at the Midland Hotel, when the newly-elected President occupied the chair, being supported at the head table by Mr. H. Sutcliffe Smith (President of the Society of Dyers and Colourists), Colonel F. R. McConnel, Messrs. John F. White, W. Greenwood, M.P., Geo. L. Craig, W. Jaffe, W. Frost, T. Fletcher Robinson, Geo. Garnett, John Crompton, H. P. Greg, and F. Lye.

Mr. H. SUTCLIFFE SMITH proposed the toast of "The Textile Institute," and paid high tribute to the good work of the retiring President of the Institute, Col. McConnel. The new President, Mr. John Emsley, was a large millowner, who had shown marked interest in the welfare of his employees, and he felt sure that he would follow up the aims and objects of the Institute with great energy and enthusiasm. It was a distinct pleasure to propose this toast, as President of a sister organisation. He had come to the conclusion that the only hope for the future was in the excellence of our work. Our productions must be got on to a higher plane, and the Textile Institute was one means to that end. We had by no means reached finality in the textile trade, and great progress was taking place. In most large works equipment and organisation were very good. But were we just as well equipped on the scientific and technical side? At any rate, a real awakening in regard to scientific methods was being witnessed, and it was a gratifying sign. Commercial progress was always shown when those engaged in industry advanced in knowledge, and he commended the programme of the Institute. He did not intend to refer at length to the contentious Dyewares Act, but its incidence pressed most hardly on the textile trade, and present prices, he considered, were much higher than the economic prices ruling for other commodities. Concluding, he said he had pleasure in testifying to the good work done by the Institute, and he wished all concerned the greatest success for the future. So far as his own society was concerned, they desired to help. He coupled the name of his genial friend, Mr. Emsley, with the toast.

Mr. GEORGE GARNETT (Bradford) responded, and said there was nothing higher to the textile community than was embodied in this Institute. It was not merely by perfection of mechanical contrivances that progress was attained, but by the spirit behind all endeavour in the industry. A bigger outlook was still required. We not only needed leaders, but every single member of the Institute should seek to advance the movement, for the Institute was out to show that industry is not something merely for livelihood but something from which immense joy and pleasure could be derived. He appealed to the younger men to join the Institute. He trusted that the spirit and desire for advancement would continue, and felt sure that Mr. Emsley would help them to greater service.

Mr. W. GREENWOOD, M.P., also responded, and said if he had to say anything about dyewares he would probably disagree with Mr. Sutcliffe Smith. That morning Mr. Emsley had asked everyone to help him in his new office, and he hoped the desire would be met. There seemed to be some difference of opinion with regard to a very important part of the Institute's work—the *Journal* publication. He would suggest that members who did not wish to see any curtailment should take a very real interest in securing that there should be no curtailment of income. After all, it was important that business people should run the Institute in a business-like manner. As means to popularising the Institute, he suggested consideration of the provision of meeting places in different centres and the creation of a Fellowship of the Institute, not as an honorary distinction. He thought there should even be an office in London. The greatest service of the Institute had been in the bringing together of the business and scientific men.

The PRESIDENT also responded, and said there was nothing to be got out of war in industry, and he hoped that capital, management, and labour might work together for the common good.

EXHIBITION OF YARNS AND FABRICS.

Later in the afternoon members and friends again gathered at the Institute premises, when an exhibition of yarns and fabrics was declared open by the President. The exhibition consisted of an invitation collection of exhibits from various sections of the textile industry. In the first place, members were appealed to, and subsequently invitations were extended in many directions. The event was suggested by reason of the success which attended an exhibition held in the previous year—at the time of the holding of the World Cotton Conference at Manchester. On the present occasion, however, a more ambitious outlook was associated with the fixture. The character of the undertaking was exceptional, and no attempt was made to commercialise the organisation of the fixture. Space occupied by exhibits was provided free to the exhibitors, and no charge was made for admission. Inspection was open to members, and to non-members on presentation of trade card. A useful catalogue was provided, and it is therefore unnecessary to repeat here the names of exhibiting firms and the details of the exhibits. It may be stated, however, that the collection covered an immense field of textile manufacturing activities, particularly in view of the limited space available. The exhibition remained open from the Tuesday to the following Saturday, and the attendance and obviously definite interest in the collection were most gratifying.

The PRESIDENT (Mr. John Emsley), in declaring the exhibition open, said that twenty years ago such a display would have been astounding. Those of them who had been born in and grown up with the trade often failed to realise the remarkable progress effected. An exhibition of this kind visualised the progress, and it was exceedingly interesting to all concerned. He believed that in the cotton industry the progress had perhaps been greater than was the case with the woollen and worsted industry, particularly in regard to manipulation for special results. Nevertheless, he believed we were on the eve of great developments in the woollen industry. More and more beautiful things were being developed from the same raw materials. Science was probably moving more rapidly than some of us realise, bringing us nearer not only to better but cheaper productions. This exhibition presented development on development, and showed that the product of one branch or of one process formed the raw material for others. He hoped the event would be an incentive to still greater achievement in the future.

In connection with the exhibition, the following paper was submitted on the afternoon of Friday, 28th April, the paper having special reference to an exhibit of a number of cloths containing faults :—

PREPARATION OF CLOTH FOR FINISHING.

By S. H. HIGGINS, Bleachers' Association, Ltd., and ANDREW HODGE,
Calico Printers' Association, Ltd.

Meeting at Manchester, 28th April, 1922, Dr. R. S. Willows in the Chair.

In his paper read at the World Cotton Congress, Manchester, 1921, Mr. W. Howarth stated:—

> " The characteristics of raw cotton which enable a spinner to attain the best results with a minimum of labour may be stated as follows:—First, and most important of all, the fibres must be even in length; secondly, the cotton must be ripe; thirdly, the grade must be even; and, fourthly, the cotton must be free as possible from dead cotton, bearded motes, seed, fibres other than cotton, sand, iron, stones, excessive moisture and other foreign substances."

The finisher's objective is also to achieve " the best results with a minimum of labour," and his success is very closely dependent on the success of the spinner in obtaining his supplies possessing the four characteristics named. By full discussion of the difficulties caused by the lack of these characteristics, not only in spinning but in the subsequent processes of bleaching, dyeing, printing, and finishing, it is hoped that the spinner's hands will be strengthened in his attempts to secure the quality of cotton he requires.

In cotton piece goods the faults which hamper the finisher in his attempts to produce the best may be roughly classified into:—(1) Cotton faults; (2) mechanical faults; and (3) chemical faults, including those associated with the size.

(1) COTTON FAULTS.

" *Black* " *Cotton*.—Black cotton cannot be bleached to a pure white, the finished piece being dull—almost grey in appearance. At the World Cotton Conference, an American stated that any black cotton appearing was sent by them for black dyeing, and this is a good solution of the trouble. But the finisher cannot return goods dyed black when they were sent to be finished white, or at all events with a white ground. Cloth woven from such black cotton should never be delivered to white finishers or calico printers. J. M. Matthews has stated that Blue Bender cotton is a variety of peeler cotton characterised by a blueish colour which cannot be removed by the usual methods of bleaching. It receives its name from the bends of the Mississippi River valley in which district it occurs. The exact nature of the colour and the cause of its formation are not known, but some authorities suppose that the defect arises from premature frost, while others assume that the cause is to be found in some ingredient of the soil. Apart from its colour and resistance to bleaching, the appearance and quality of the fibre are unimpaired. The United States Department of Agriculture finds that middling yellow tinged cotton when bleached can be used for dyeing both light and black shades, but good middling blue stained and middling blue stained can only be bleached satisfactorily for dyeing dark shades.

Unripe fibres.—Mr. Howarth, in the paper already referred to, has described how unripe fibres are responsible for spinning difficulties resulting in the formation of neps, and has stated that spinners are called upon to meet claims for damage caused by such fibres in the finished cloths. Several illustrations of the effect of these neps in dyed and printed goods are now submitted. In some of the specimens, which by the kindness of Dr. Crossley, of the Shirley Institute, will be more fully described by Dr. Harland, the thickened parts of the yarn which resist the penetration of the colour have been found by Dr. Harland to be composed of quite ripe cotton. They are, therefore, not neps in the ordinary sense of the term. In the experience of one of the authors, when a cloth contains a large proportion of those thickened parts of the yarn which resist the penetration of the cloth by the colour, the shade produced, even on those portions of the cloth that are apparently woven from perfect yarns, is lacking in brightness, as illustrated by one of the sets of patterns shown.

Leaf.—Many of the cloths, particularly those woven with the coarser counts of yarn, contain a very large proportion of leaf which remains from a pale buff yellow to dark brown after the goods have received a normal bleach. This is a very objectionable feature in many styles, and, at its worst, leaf is also capable of showing " speckiness " in the ultimate dyed goods, as illustrated in one of the examples.

(2) MECHANICAL FAULTS.

Under this heading would fall those due to unevenly spun yarns, uneven weaving, floats, etc. Most of these features are recognised as faults by the manufacturer, but many of them are exceedingly difficult to locate in the grey cloth, even when a close examination of it is undertaken by the finisher. The most outstanding faults of this character, to the dyer or printer, are probably those of uneven weaving which gives alternately thick or thin places in the weft or reediness in the warp, and which, although in many cases hardly noticeable in the grey, show up in the ultimate dyed or printed goods as light and dark places, constituting what is known as " streaminess."

A defective sand roller on a loom causes small holes in the cloth, and sometimes these holes are accompanied by small particles of iron rust, if the loom has not been used for some time. These holes are sometimes difficult to see in the grey goods, even with careful examination, but the bleaching process enlarges the holes. The temple of the loom causes similar holes, but at the sides of the cloth. The grey plaiting machine has been proved to cause damages from time to time, and these damages, in the form of small holes, are difficult to trace to their source.

Pins, teeth of steel combs, hairpins, etc., left in cloth by weavers, cause stains and tears in the cloth. Sometimes these articles remain in the cloth to the end of the process and get into the calender bowls. For instance, it is a common thing to get heddle wires in calenders from goods woven on jacquard looms. These wires are used to separate the warp threads; if they become attached to the cloth and get into the calender bowls, small round holes are cut in the cloth going through the calenders. A thin place or " felter " had been carefully made up by the weaver to escape detection almost, but after finishing a square hole was found. Cropping machines sometimes cause small holes by pulling bits of cloth out along with the loose threads. With the strain of the bleaching and finishing machinery, a small square hole results. If the warp threads only are cut, then the strain of the machines pulls the cut warps apart in a regular manner; but if both the warp and the weft are cut, then an almost square hole results. A cropping machine can also damage cloth by the knife blades not being properly adjusted. Sometimes the weft threads are cut badly, and the manufacturer tries to refer blame for the defect to the tension in mercerising or stretching. Bad frets in the cloth sometimes make finishing impossible.

The structure of the selvedge is of importance to the finisher. In some cases the selvedge curls, which renders printing, dyeing, and finishing difficult, and in many cases practically impossible. It must be pointed out to merchants and manufacturers that in order to get certain finished effects a definite process must be followed, which means that the cloth must have a definite and large number of runnings. If finishers give more runnings to their cloth than is necessary, the cost of production is too high and is soon noticed, so that the tendency is against over-working the cloth. But the cloth received must be capable of standing the runnings necessary, otherwise the finishing works is turned into a nursery.

If the selvedges are hard and round, instead of having the flat tape appearance, they are liable to cut or tear away from the body of the cloth, and if the threads in the selvedge are badly drawn they tend to form a hard solid selvedge which may be an advantage in weaving, but gives trouble when calendered. Irregularity in the manner of threads in a selvedge caused by bringing in loose ends will sometimes cause damage in those places where extra threads have been introduced.

Mr. Bancroft (U.S.A.) spoke at the Cotton Conference on faulty selvedges. They had, he said, very little trouble if they could get the co-operation of the mill manager. If you attempt to strengthen the selvedge at the expense of the warp threads of the cloth, then the strain in process is taken by the selvedge, and damage results. They draw eight threads as four in the selvedge. Also, if the makers of the cloth twist their threads spinning twist instead of twisted twist, then the selvedge threads will stretch at least 6% more than threads with twisted twist.

Many weavers' seams are so stitched together that they will not carry through the finishing process; sometimes they are not stitched at all, and, breaking the continuous run through the first machine, it is necessary to thread the machine up again. Owing to this loss of time and inconvenience, such pieces should be distinctly marked in coming from the loom.

(3) CHEMICAL FAULTS (including those associated with size).

Faults of the Size.—The finisher's troubles from this source arise from excessive quantities of size being used and from the use of undesirable ingredients in the size, such as zinc and magnesium chlorides, paraffin wax or tallow containing paraffin, and from the use of colouring matters which cannot be bleached out. It has to be borne in mind that all the size put into the warp has to be removed by the finisher during the process of bleaching, and the less he has to remove the better. If the weight of size to cloth was constant, the bleaching operation could be controlled with a greater degree of precision. Far from being constant, the percentage of size on the grey weight of cloth found in a number of printers' cloths, taken at random, varied from as low as 6% to as high as 35%.

The use of magnesium and zinc chlorides has considerably decreased as the result of the finishers' campaign against such use, but it is still in evidence from time to time as shown by small holes caused in the singeing process, in extreme cases causing serious tendering of the whole of the cloth. As many cloths are now delivered free from chlorides, it would seem reasonable to assume that those manufacturers who still use them could without serious difficulty discontinue their use. It may be useful to mention that some of the ready-made softeners sold for use in sizing contain these chlorides, and a manufacturer buying such products might therefore be using them unwittingly.

We have come across cases where China clay has been used for sizing light goods. Now this material is not easily removed by the bleacher, who cannot repeatedly alter his process because different manufacturers are trying materials to cheapen their sizing process. It was found that the China clay was not entirely removed in the bleaching, and the residual clay affected the finish of the goods. The finisher has quite sufficient to do to select his process to give a certain finish without having to consider such variations in his material as mentioned.

Recently a non-injurious sizing, which does not involve the use of foodstuffs and is removable by boiling water, and contains sodium silicate, aluminium sulphate and China clay, has been patented (No. 169,103 of 1921), but bleachers do not often boil cloth with water, and, from what has been stated above, it is questionable whether the clay might not cause some trouble.

A merchant asked for goods from the manufacturer containing 30% of filling, but as those goods were sent to the finisher direct by the manufacturer the latter asked the finisher if this filling was necessary or whether he could fill them as desired. The finisher took the goods without filling, and supplied them finished as the merchant desired, saving a large amount of filling material and preventing possible trouble in the finishing process.

The use of excessive amounts of fatty matter in the size is also a fruitful source of trouble and irregularity to finishers, even when the fatty matter used consists of pure tallow which is mainly saponifiable. It is difficult for the finisher to understand why some cloths are found to contain as much as 2·5% of fatty matter, while other similar cloths contain only 0·6%.

Tallow is the fat largely used in sizing mixings, and it should be borne in mind that many commercial tallows are adulterated with paraffin wax, which, being unsaponifiable, is not removed by the process of bleaching and gives rise to stains of various character in the finished goods. Commercial "tallow" has been found to contain as much as 50% of unsaponifiable matter, and tallow has been sold to manufacturers as pure beef tallow and found to contain 15% of paraffin wax. A guarantee should be obtained that the tallow bought is free from paraffin, and then the seller could be madé responsible for any trouble caused. Cases are within our knowledge of spermacetti wax being used in sizing mixings, which, being also unsaponifiable, cause trouble in finishing. Such paraffin or wax stains in finished cloth are of a particularly objectionable character, as they are invisible in the grey, incapable of being removed by any ordinary bleaching process, and almost invisible in the white cloth. The affected parts of the cloth, however, resist dyeing and finishing. C. O'Neill has pointed out that Japan wax is not suitable for sizing mixings. It is only partially saponifiable, and therefore not readily removed in the scouring operations.

A manufacturer writes that a size containing soap, paraffin wax and paraffin oil is used for light sizing because it is cheaper than tallow, and he asks if it should be condemned. It may be that, with the soap being in a larger amount than the mineral wax and oil, the separation of the wax and oil from the emulsion would not be likely. At the same time, there is no reason to use these substances, and we wish to press home to manufacturers that they are running a risk by using these substances at all.

Recently a case of paraffin-wax staining came to our notice where it was evident the trouble was caused in using blocks of paraffin wax for rubbing on the threads during weaving in order to lubricate them. Now the wax taken up in this way is small, but, when we have four tons of cloth in a kier and the wax in the cloth melts and gets on to a few pieces of cloth, there is quite sufficient to cause trouble. Paraffin and similar waxes should not be allowed in the weaving shed.

A manufacturer recently stated that the adoption of tallow in place of paraffin wax for sizing might mean £100 a year to a weaving shed. Wax is about £30 a ton and tallow £40, so you can soon figure out what difference it would make. Then, consider what risks you are taking of having faults thrown back upon you. Any paraffin wax found in the cloth can easily be detected by a trained chemist, and the trade knows that only the sizer can be blamed for it. The saving is not worth the risk, and a great effort should be made in the interests of the industry to eliminate paraffin absolutely from the sizing and weaving branches.

Mr. Sagar, at the World Cotton Conference, asked that a committee of experts be formed to construct a formula which they will swear is the best size for weaving purposes, and no doubt some action on these lines would be useful, but the great point is to convince manufacturers of the benefit to be gained by co-operation and by abandoning, in sizing, the use of materials known to be obstacles to the achieving of the best by the finisher. (Several examples were here shown of the effect of paraffin in dyed goods.)

Under this heading of stains due to paraffin, it may be useful to refer to a similar trouble which arises from time to time from the practice of covering up a float or other weaving defect with paraffin wax, or soap containing it. Although only a single float in a lump may have been so treated, yet when that lump is put into a kier along with two tons of cloth the paraffin melts, floats about in the kier and may stain many lumps with all sorts of irregular shaped stains for which the finisher has to accept the responsibility, owing to his being quite unable to trace them back to their real source. Warps have been known to be tinted with a yellow dyestuff to make them appear like Egyptian cotton. The dyestuff could not be bleached out, but spread a yellow tint over the cloth and damaged it. For some classes of weaving the tinting of the warps is said to be an advantage, and blue tinted warps are sometimes used in jacquard looms, but great care should be taken that the dyestuff used is easily removable in the bleaching process. Yellow ochre has been used in sizing mixings, and caused trouble in the subsequent bleaching of the cloth.

Amongst chemical causes, we include stains due to mineral oil which may have come in contact with the yarn or cloth in the course of spinning and weaving, from drippings from the roof, or from the slasher cylinder covers, yellow or black bars from cracked bobbins, the oil getting on to the roving, or oil from the roller necks and in the top boards in the card room. When the weaver pieces a thread, an oil stain will result if she has oil on her fingers, and this stain cannot be removed in the ordinary bleaching process. Marks from picker bands, due to oily and waxy matters in the stuffing of the leather, will not come out, and they leave yellow marks. If the stains are from pure oil, they show up yellow in the finished piece, but if the lubricating oil has come from a bearing and contains any copper or iron from the machinery then the trouble is greatly aggravated. Cases have been known of pieces of cloth falling in two pieces at the finishing owing to one warp thread containing such metal-contaminated oil, the thread consequently having become tender in the process and having also tendered the weft. When the cloth containing such oil is well scoured, part of the oil may be removed, but not the metallic particles, and these are rarely completely removed by the subsequent souring. They remain in the cloth and are frequently quite invisible in the white goods, but they become visible either as resistant places to the colours subsequently applied or as coloured stains in the white portions of dyed goods, and when such goods are chemicked to produce the ultimate white required the metallic particles act on the chemic, giving off oxygen and tendering the cotton with which they are in contact. If the contamination has taken place in the spinning, only single threads may be affected, producing cuts in the cloth, but if the stain has spread to more than one thread, as would be the case if caused in weaving, holes may result.

At times, attempts are made at the mill to remove these metallic stains by treatment with oxalic acid or salts of sorrel, but this is an exceedingly dangerous practice, because, if the acid is not completely removed by washing, local and perhaps more than local tendering is likely to result.

A Belfast manufacturer at one time tried to get rid of oil stains entirely, and he succeeded to a large extent; but when the looms were standing at the week-end he found it practically impossible to prevent contamination. These were jacquard looms with complicated overhead harness. He then used an oil which was saponifiable in the bleaching—namely, lard oil—and his troubles were thereby greatly reduced until he got a delivery of oil which was badly adulterated. This oil showed the well-known bloom of mineral oil and contained very little animal oil. The manufacturer has these troubles of purity of supplies to contend with as regards the fats he buys for his size, his softeners, and his lubricating oil, and on this account we cannot expect our troubles under these heads to cease entirely, no matter how careful the manufacturer is. Some years ago it was shown that, by using a lubricating oil containing 75% of colza oil and 25% of mineral oil, any oil stains would be removed in the bleaching process. It would be interesting to note if such an oil has been adopted to any large extent in the weaving industry. Experience shows that in a matter of this kind a slight difference in cost is the factor that decides adoption or rejection.

White-lead stains from looms and other parts of the textile machinery will not bleach out, but leave light brown stains.

The bleeding of dyestuffs in the bleaching process causes a lot of trouble and probably always will. The question was asked at the Cotton Conference whether we were encouraging certain yarn dyers whom we knew produced fast colours at the expense of other yarn dyers, but it was pointed out that we were acting in the interests of the trade in general—that is, endeavouring to minimise faults under this head. We feel that even if co-operation takes place in this matter we have always the human element to consider. Moreover, it is more likely for variations to take place in the process of dyeing, which is sometimes a long and difficult one, than in the process of bleaching, which is more or less standardised. For instance, Turkey red for headings is sometimes a variable colour. Dyed by the old process, it is said to be faster than by the new one, and rancid olive oil is stated to give a better product than Turkey red oil. Some vat colours to which the dyers will give no guarantee are used by manufacturers. The manufacturer takes the risk, and the finisher does his best, but if bleeding occasionally takes place for no reason that the finisher of the cloth or the dyer of the yarn can explain the manufacturer must always remember he is using colours which are not guaranteed for the cloth he is producing. The merchant likes the headings, but the goods are finished with risk every time.

Immediately after the Cotton Conference, a committee was formed to go into the question of the fastness of colours to bleaching. There are difficulties in this matter, but the committee is making headway. Then, we have recently had the laundries putting in their word on this matter. Perhaps this industry can also be roped in and work of general importance done.

Mr. O'Neill (Bleachers' Association, Limited) has described his work on the subject of "Gold headings" in a paper before the Association of Managers of Textile Works. Trouble is caused to bleachers by the rubbing of the gold thread and the use of poor gold thread which exposes the silver and causes it to blacken more readily. There appears at times to be variations in the quality of the gold thread, with blackening of the thread and the tendering and destruction of adjacent cotton threads. Manufacturers have at times bought inferior gold which would not stand the bleaching process. Instead of being a drawn silver wire with an extremely thin coating of gold, it has sometimes been a gilt copper wire.

GENERAL.

When such chemical faults as have been described are pointed out to manufacturers, it is frequently contended that the bleaching is at fault. We do not, of course, contend that our bleaching is never at fault, but it should be borne in mind that, if attempts are made to remove foreign matters such as the paraffins we have referred to by more drastic methods of bleaching, the finisher is running two serious risks, the first being that of rendering his cloth unsuitable for the finished effect required, and, more serious still, the risk of weakening or actually rotting the cloth. Short of running these risks, it may be taken that the finisher is continuously attempting to remove all foreign matters as completely as practicable.

J. Taylor, at the World Cotton Conference, said the manufacturer would be held liable for damages arising from chlorides or injurious material used in the manufacture of cloth. "From the merchant's point of view this is a useful clause, as it calls the attention of the manufacturers to a liability which is not generally known in law—if the manufacturer knows the goods are bought for the purpose of finishing there is a warranty implied that they will be fit for the purpose. The contrary, I think, obtains if the manufacturer is not aware the goods are to be processed, and he has merely put in magnesium chloride or other substance for the purpose of improving the appearance of the cloth in the grey."

The position, however, could easily be made stronger from the finisher's point of view, for he ought to insist that no chlorides or unsaponifiable waxes should exist in the cloth he receives. They are not necessary, and such a position would make the manufacturer careful to get from the suppliers of tallow and softeners for the sizing mixings a guarantee that they contained no wax on the one hand and no injurious chlorides on the other. From time to time, we still find sizing mixings recommended which contain those chlorides, in spite of the fact that other softening agents are available. Since the cause of the faults produced during the singeing is not thoroughly understood, it seems a bad policy for weavers to have any of these chlorides inside the weaving shed. At any rate, it is necessary for finishers to keep this matter continually before manufacturers.

Regarding faults in cloth, Mr. Taylor says:—"If a manufacturer sells cloth knowing that it has to go through a process he will be liable in respect of defects which the process discloses, and which were not apparent in a reasonable examination of the goods in the grey. If on a reasonable examination the grey did not reveal the defect, but it became apparent during, or by reason of, the process, the buyer and therefore the finisher would have a good claim." A lot turns, however, on the wording "reasonable examination," a matter which has been discussed previously. One would take it that such a ruling would apply to, say, sand roller damages and small damages caused by the grey folding machine.

Mr. Manley (Sayles Bleachworks, U.S.A.) at the World Cotton Conference said the Americans would be glad to co-operate in introducing a standard form to be filled up to indicate cloth faults. Since his works received some grey cloth from this country for finishing, he suggested a joint advisory board to deal with these matters.

As regards stretching goods to width, it must not be forgotten that there is a certain amount of stretch which can be given to fabrics beyond which the strength of the fabrics is decreased. It is important that merchants realise this.

Sometimes managers of finishing works do not care to take up faults in the grey cloth sharply with their customers because friction is not cultivated in business, but attention to the matters now brought forward would assist the work of the finisher, lighten the risk of liability of the manufacturer, and improve the productions of the trade in general. At the Cotton Conference, instances were mentioned where finishing had been improved by the co-operation of the spinner, sizer, and the dyers of yarns with the finisher.

After Mr. Higgins had read the foregoing paper,

Mr. HODGE referred in detail to some of the faults revealed in the samples of fabrics exhibited. He said he hoped the impression had not been created in the minds of manufacturers that Mr. Higgins and himself were there to lay the blame for all faults pertaining to the cotton industry on the shoulder of the manufacturer and to whitewash the finisher by so doing. In approaching this subject, they felt from their experience that an approach along the avenue of the consideration of faults was likely to yield the most valuable suggestions as to how to secure the improvement in the textile productions of Lancashire which many people thought would be necessary in the difficult days of stress and competition ahead in order to secure the maintenance of ascendency in the markets of the world.

In regard to mineral-oil stains, it was to be remembered that not every such stain produced a fault. It was obvious that stains caused by the oily fingers of the weaver in an enormous number of cases did not appear in the ultimate goods. Cops had been dipped into all sorts of oils, and in many cases they had been able to bleach out the stains or marks. The cause of the stains which gave rise to faults presented a highly complex problem. Whilst some of the injurious stains were undeniably due to oil, yet they did not know the precise character of the oil giving the effect nor the exact conditions which the yarn, the cop, and the cloth went through in order to produce the result. They appealed to the manufacturer, however, for closer consideration of the ultimate requirements of the bleacher, and, finally, of the consumer. Personally, he yielded to no one in his admiration of the marvellous achievements of the Lancashire manufacturers, but it did appear to him, from his experience of bleaching, printing and finishing that whilst hitherto every attention had been given to the mechanical side of the industry there had been a tendency to neglect the chemical and physical sides of the materials handled and of the subsidiary materials employed. He wanted those interested in spinning and weaving to believe that it did not afford the finisher any satisfaction to have to return goods to the manufacturer and debit him with them. Business had been lost by this sort of thing. If the finishing industry was at fault in any way, then it was hoped that defects would be ascertained and overcome, and it was hoped the Cotton Research Association might be of considerable assistance in this connection.

Referring to a particular specimen of faulty fabric, Mr. Hodge said that a tinplate roller was used on the sand roller, and the probability was that the cloth was left sufficiently long in contact with the tinplate covered "sand" roller to pick up iron rust, thus making the soap insoluble. Even if pure soap were used, unless it were rationally applied the risk was run of giving trouble to people handling the cloth subsequently.

Regarding the use of oxalic acid for removal of iron stains, by the courtesy of a mill manager they had received a slab of material, in appearance resembling Brookes' soap, which had been used for this purpose. It contained 70% of mineral matter —probably fuller's earth—and 25% binoxalate. An operative had used this material in order to cloak a fault. These people overlooked the fact that if the cloth so treated was run over the singeing plate the cloth would be tendered in the parts treated. Oily, acid, and soap stains might not amount to a great percentage in the total, but it was not the immediate magnitude of trouble which counted so much as the amount of trouble at subsequent stages.

Regarding faults in dyeing ascribed to " dead " cotton—immature fibres—it was hardly conceivable there could be sufficient of it to account for the general inferiority in shades shown in the different specimens on view. Dr. Crossley and his assistants, of the Cotton Research Association, had investigated the matter, and it was shown that they were tufts of cotton fibres collected on the yarn. It was probably due to difference between two grades of cotton—either physical difference in the cotton itself or that the natural wax in one case was less saponifiable than in the other and so resisted penetration of the liquor. If this were the case, then the suggestion arising was that there should be closer study of the methods of sampling cotton. Dr. Harland, from the Cotton Research Institute, would show a few photomicrograph lantern slides produced in connection with the investigation.

Dr. Harland next showed the lantern slides and explained the various features of interest.

DISCUSSION.

The Chairman said the proceedings that afternoon formed an instance of what co-operation could and should do. The question of dead fibres interested him greatly. He had found that in finishing a fabric something could be produced which aped the defect in question, and it was produced by the simple process of ironing with a hot iron. It could be produced artificially in a sound fabric. Could this be produced by singeing ? Being a great believer in the utility of the microscope as an aid to understanding difficulties in regard to textiles, he was glad to have seen the slides submitted by Dr. Harland. Consideration of the behaviour of cotton under the microscope, when the cotton was treated with various solutions, was helpful. In a case of a sample of cloth showing minute holes, the question arose as to whether the defect was due to tendering or mechanical fault. On examination with various solutions, he found the fault was undoubtedly mechanical.

Prof. A. J. Turner (Manchester) said the paper had been of the greatest interest, especially to those who knew how successful the authors had been in overcoming their difficulties. It was a matter of extreme difficulty to find out what faults were due to, and an investigation which was conclusive was a work of triumph. During the war, in connection with aeroplane fabrics, there was much difficulty with fabric which would not take dope satisfactorily. Eventually the specification provided that no size should remain in the fabric, and the manufacturer had to scour. Even then, however, the difficulty was not entirely overcome, and it was found that some manufacturers using tallow and sago had not been using the pure article. The apportioning of blame was a large question. The manufacturer had to buy, and he knew to his cost that things were not always what they seemed. It was essential that co-operation should exist to find out the causes of faults, and an excellent illustration had been given that afternoon of what co-operation could do.

Colonel F. R. McConnel, in proposing a vote of thanks to the contributors, said he hoped the movement for better co-operation between the different sections of the industry would continue to develop. Its importance had been urged over and over again from the platform of the Textile Institute. An Institute conference on the subject of sizing materials, held at Manchester some years ago, showed what an immense amount of good could be done for the trade if these matters were taken up seriously. In his own experience, oil stains had occurred on cloth, although they knew there was no mineral oil used. Finally, however, it was tracked down to the bobbins on the slubbers. In these matters, the endeavour must be to get to the root of the difficulty. Prevention was better than cure and better than any amount of discussion with a view to cure.

Another speaker referred to thick-and-thin places in cloth. In one case, where a calico printer had rejected cloth, he said, the manufacturer said he would have to close down if such cloth was rejected.

Mr. JOHN CROMPTON, seconding the vote of thanks, said he believed it was possible to eliminate the majority of these faults. Thick-and-thin place preventers on looms would eliminate this particular fault, and there was in existence an appliance which would be available to be fitted whereby a loom could be stopped on the first pick. He was glad to second the vote of thanks, as the Institute had been most anxious to encourage this co-operation.

The authors acknowledged the vote, and Mr. HIGGINS said this matter would not be allowed to rest until some practical result had accrued.

YORKSHIRE SECTION

Meeting at Bradford, 26th January, 1922, Mr. John F. White in the Chair.

THE ECONOMICAL PRODUCTION AND USE OF STEAM

By J. R. HANNAN.

In order to generate steam, two steps are required:—(1) Procure the heat, (2) transfer it to the water. Our chief source of heat is that obtained from the store of "latent chemical energy" present in coal, such heat being evolved during the "process of combustion" and transmitted to the water by conduction through the heating surface of the steam plant. We have now to acknowledge an elementary principle—that when a body has been transferred or transformed from one place or state into another the same work has been done and the same energy has been expended. Therefore, when a given quantity of water has been transformed into steam, we know that a definite amount of work has been performed and a certain amount of energy expended from any source of heat supply without regard to shape or type of boiler. Thus, a pound of fuel has a definite heat-producing capacity and will evaporate a given quantity of water; it cannot do more than this even if the transformation was carried out at 100% efficiency. Yet we have all heard of cases having been certified by so-called engineers claiming much higher results.

Turning to the practical side of the question, the steam generator is a two-part proposition. First, we need the furnace for the proper combustion of the fuel, and, second, the heating surface for the transfer of the heat generated into useful effect by evaporating the water into steam. The capacity of the furnace to consume fuel in the main part denotes its steam-producing capacity and the amount of heating surface provided in the generator over which the products of combustion will pass on its way to the chimney (assuming the fuel to be consumed with the correct air supply) will decide the economy with which the steam is produced. This heating surface is usually made up of boilers, superheaters, and economisers, in suitable proportion. The rate of heat transmission depends upon the specific conductivity of the metal and the temperature difference of the two sides. It follows therefore that if we provided the whole of the surface necessary in boiler and superheater only, a good deal of it would transmit very little heat from the point where the temperature of the gases was approaching the temperature of the steam corresponding to the pressure on the water-side of the plate. Hence, we find it possible to obtain a more effective over-all transmission of heat by introducing a feed-water heater in the form of an economiser where the feed-water can enter the system at a temperature much less than that of the water in the boiler.

Combustion may be defined as "the union of two dissimilar substances evolving light and heat." In ordinary practice, one of these is the oxygen of the atmosphere and the other the fuel employed. Every pound of fuel requires a certain quantity of oxygen for its complete combustion, and thus a given quantity of air. This varies with different fuels—the minimum quantity producing the greatest calorific intensity or fire temperature, while less than this prevents complete combustion.

On the other hand, an excess of air causes waste of heat to the amount required to bring it up to the temperature of the escaping gases. The average calorific value of Yorkshire fuel may be taken at 12,000 B.T.U.'s per lb., and the theoretical quantity of air for combustion would be 12 lbs. In practice, however, we find it necessary to provide an excess of 50%, equal to an air supply of 18 lbs. per lb. of fuel. Therefore, the resultant products of combustion would have a CO_2 content of 12·8% as against 19·2% if it were possible to use the air supply of 12:1.

It is, therefore, important that those in charge of a steam plant should have some means of testing for the amount of CO_2 present in the products, and same should be observed at a point where the gases only contain the air that has passed through the fire. In a good many cases where this kind of test is carried out, it generally conveys nothing to the observer or those responsible for ordering the fuel other than to compare it with some ideal reading usually supplied by the maker of such apparatus. If the air for the combustion had to be ordered and paid for like fuel, 18 tons of air would be ordered for every ton of coal, and if used in a greater proportion it would be evident that waste was taking place. Therefore, in order to ascertain what is going on, the average daily or weekly reading of the CO_2 should be converted into air supply, readily possible by multiplying $\frac{19{\cdot}2\times12}{CO_2}$, and the engineer should be challenged if it exceeds 18:1.

Now, in order to obtain the maximum economy, it is necessary to provide 1 sq. foot of heating surface for the absorption of the gases resulting from the burning of each and every 4/10ths lbs. of such fuel, or in case of difference of quality of fuel the equivalent result can be obtained by providing 1 sq. foot of heating surface for every 3¾lbs. of steam produced as from and at 212°F.

It should be understood that combustion can be carried out under various temperatures and rates, and with any air supply, without affecting the quantity of heat generated.

But for the reasons already given we find it necessary to limit the latitude in practice in order to obtain the most available heat from each pound of fuel. There are three ways in which the heat can be accounted for:—(1) That transferred to the steam; (2) heat discharged to the chimney by the waste gases, which is in proportion to the weight of the gases and the difference between the temperature of the air before it entered the fire; (3) radiation from all the surfaces of the steam plant exposed to the atmosphere. The first and second depend entirely upon the amount of heating surface provided in the steam plant and the difference between the temperature of combustion and that of the chimney gases. It will be evident that the temperature of the escaping gases cannot be reduced below that of the heat-absorbing surfaces, though the temperature may be further reduced by allowing air to leak into the flues after the gases have left the heating surface. But this does not reduce the amount of heat wasted. It is in this way that low chimney temperatures are sometimes passed off as proof of economy.

On the other hand, surplus air admitted to the fire or to the gases before they leave the heating surfaces increases the losses—hence, the fallacy of admitting air over the fire and at the bridges with the object of smoke prevention.

As previously mentioned, the furnace temperature is dependent upon the air supply for combustion, and the following will give us some idea as to how the temperature at which combustion is carried out can affect the economy.

Assuming there is no air in the products of combustion other than that which has passed through the fire, we will then find that the losses by the chimney gases will bear the same proportion to the heat generated by combustion as the temperature of the chimney gases bears to the calorific intensity of combustion or temperature of fire. Thus, with the 12,000 B.T.U. fuel and an air supply of 18:1, and taking the specific heat of gases as ·25, we find that the fire temperature will be thus:—

$$\frac{12{,}000}{\cdot25\times(18\text{ plus }1)}=2{,}530^\circ\text{F.}$$

Taking the average temperature of the gases entering the chimney to be 460°F., then the heat carried away by chimney $=\frac{460\times100}{2{,}530}=18\%$. It therefore follows that as the temperature of the escaping gases can never be brought below that of the absorbing surface, the temperature of the fire must be high in order to secure the best results.

The loss by radiation being practically in proportion to the time occupied for burning a certain amount of fuel, it follows that the more coal burned in the furnace in a given time the less will be the proportionate loss from this cause. Part of it can also be eliminated by covering the surface with good non-conducting materials and air-packed cavity walls; nevertheless, it all proves conclusively that we should burn our fuel rapidly and at as high a temperature as possible in order to secure the maximum economy.

The fact that these general principles are often overlooked leads to a good deal of money being wasted, year after year, on all kinds of stoking appliances, patent fire bars, etc., with much disappointment both to the inventors and steam users. In actual practice, a total thermal efficiency of 75% can easily be obtained if these principles are observed, thus leaving 25% for heat carried away by chimney, radiation, and heat unaccounted for.

A natural draught chimney is capable of consuming fuel at a rate equal to $2\sqrt{\text{Height of chimney plus 1}}$

For natural draught, the nett area of chimney required equals

$$\frac{\cdot 07 \times \text{hourly rate of fuel consumption}}{\sqrt{\text{Height of chimney}}}$$

In practice, the height need not exceed 150 feet except where surrounded by hills, and as a round chimney is better than a square one, equal in bore throughout—the diameter in feet should be $\frac{13\cdot 5 \times \sqrt{\text{Nett area plus 4}}}{12}$

In certain cases it may be necessary to instal an induced draught fan, but it must be observed that the power absorbed will be a charge in addition to the heat carried away by chimney, and same is usually sufficient to warrant the capital outlay of a new chimney.

Mechanical stokers, with moving bars for self-cleaning the clinker, permit of a finer adjustment in air supply than the hand-fired furnace, and, in consequence, a little more economy can be obtained, but against this we have the factor of wear and tear to contend with. The chief advantage of mechanical stoking, therefore, especially if fed from an overhead coal storage bunker or fuel elevator, is the labour saving.

Forced draught can also be applied where the natural draught is poor or where it is an advantage to use small fuel. But great care should be taken to proportion the grate area so as to secure the best economy. For boiler plants of a reasonable capacity, the Lancashire boiler stands first for all general purposes, and the dimensions required for the installation can be considerably reduced by observing that no good purpose is served by making a Lancashire boiler longer than 24 feet. Such a boiler will produce just as much steam as one 30 feet long, and the same economy can be obtained by providing extra heating surface in the economiser to make up for the reduction in length. The ideal proportion of heating surface being provided is as follows:—37% for boiler, 10% for superheater, and 53% for economiser. The cost of the brickwork setting will be less, and it will also be found that the shorter boiler with a larger economiser will cost less than the combination necessary for the 30 feet boiler.

Water tube boilers have a useful place when space is limited and when a large capacity is required such as for power stations and in all cases where the steam pressure exceeds 200 lbs. per square inch. Here, again, the same laws regarding heating surface and furnace conditions must be observed if results equal to the Lancashire boiler are to be obtained. All water tube boilers are subject to scale trouble with impure feed water, and the cost of furnace brickwork, repairs, and general maintenance will be found more than that of a Lancashire boiler plant.

Before leaving the question of steam production, I would just like to add that, after obeying all the principles before mentioned, the cost of steam production depends upon the price you pay for the fuel consistent with calorific value together with the labour charge involved in performing the duty. It is a good point to remember that it is heat you are buying, and, generally speaking, the cheapest fuel is that in which you obtain the most heat units for each penny spent. Therefore, all coal should be bought at a price proportionate to its calorific value.

During the recent coal strike a good many steam users resorted to the use of oil, with varying success. The installations which came under my notice consisted generally of a pin-jet with steam atomisation, with indifferent provision for heating the oil, and fixed in such a manner that combustion was not properly supported owing to the close proximity of the atomised oil, being consumed too near the heating surface. The steam taken for atomising was anything from 10% to 20% of the amount produced in the boiler, while the air supply was quite inadequate to complete combustion. In most cases I found this to be as little as 15:1 instead of 25:1 necessary with oil having a calorific value of 18,000 to 19,000 B.T.U.'s per lb.

Steam atomisation is an abortion, and, if oil is to be consumed successfully, the pressure system will have to be employed, preferably at from 50 to 125 lbs. pressure per sq. inch and pre-heated to the most suitable temperature for its characteristics. The jets must be carefully constructed, and each boiler supplied with a range having different capacities so as to meet the various demands for steam.

Twenty-five years ago it was suggested that wonderful results could be obtained from oil fuel, but, just as now, it proved to be a myth, as the price at which it can be obtained settles its commercial value. Assume ordinary fuel to have a calorific value of 12,000 B.T.U.'s per lb. and ordinary oil to have 18,500 B.T.U.'s; then, without any other consideration, the price of oil should only be 1·55 times the price of coal. We can afford, however, to add a little more to this for the saving effected in labour and removal of clinker and ashes that form part of the coal firing, but, making every allowance, we find that to be a commercial proposition the price of oil cannot exceed twice that of coal.

I have already indicated the elementary principles of combustion, from which you will gather that after you get combustion well supported by means of a fairly thick and good hot bed of fuel, all the fireman has to do is to cover the surface with green fuel, when the air will combine with the fuel automatically carrying on combustion under almost fool-proof conditions; and yet we have inefficiency due to excess air supply finding its way through thin or uncovered portions of the grate bars. If we cannot obtain sufficiently intelligent firemen to satisfy these elementary requirements efficiently, what kind of men would be required to carry out combustion of oil in which the attendant has absolute control of the air supply. It follows, therefore, that this in itself is a serious handicap, as the person in charge of such an installation would have to be trained in physics and chemistry to understand exactly what is taking place or be at the mercy of the very often unreliable CO_2 recorder. More than this, he would have to adjust the oil supply or alter the size of oil jet to suit the varying demand for steam, so that the possibility of waste due to excess air or due to incomplete combustion would be much greater than in coal firing. Lastly, there is the dangerous element of the formation of carbon monoxide gathering in pockets of dead parts of the flues while the plant is at rest, resulting in explosions when the plant is put into operation.

Now, dealing with the use of steam, we have seen that in a good plant the steam possesses 75% of all the energy in the combustible or 9,000 B.T.U.'s out of each 1 lb. of fuel having a value of 12,000 B.T.U.'s. Measured by Joules' "Mechanical Equivalent of Heat," this would represent 7,000,000 ft. pounds of energy, which if used in an ideal engine would give us 3½ h. power for one hour—equal to a fuel consumption of ·285 lbs. per h.p. hour. In practice, however, we find that with the greatest possible refinement in engine construction we have to be satisfied with a fuel consumption of 1½lbs. of coal per I.H.P. hour—equal to an efficiency of 19% of the energy delivered by the boiler. In everyday practice the average engine uses upwards of 3½ lbs. of coal per h.p. hour, and therefore discharges unutilised 93% of the energy delivered to it. This, of course, is by comparing the actual results with the ideal engine and accepting Joules' equivalent. Turning to the properties of steam, we find that the greater part of this loss is in the latent heat of the steam, which is exhausted into the atmosphere or condenser when the steam is solely used in the engine. By the Rankin and Carnot cycles the waste is not so enormous, and many scientists now accept the theory that the latent heat must be an efficient source of energy as well as the "sensible heat," and suggest there would be no available energy if there was no "latent or specific heat."

All research in attempting to find another vapour as a substitute for steam has shown that as the limits of the lowest available temperature and of the highest practical pressure are the same for all vapours, it becomes evident that the fluid having the highest temperature at the limit of pressure, other things being equal, has the advantage in the greatest possible economy. Over and over again it has been proved that water fulfils this condition best, and up to the present we have not been able to discover a better and more efficient substitute. At the moment, therefore, we must accept the inevitable and be satisfied with an engine that will give us an h.p. for a fuel consumption in the neighbourhood of 1½lbs. In recent years we have seen that these results can readily be obtained and even surpassed in the turbine by paying attention to the vacuum and superheat. It is not unusual to find the condenser in such plants producing a 95% vacuum and using steam superheated to a total of 700°F. at pressures of 200 lbs. per sq. inch and upwards. Unfortunately, however, these excellent results can only be obtained at the cost of extra power being absorbed in the auxiliaries and extra cost of installation, and from a capital point of view the results so obtained are no better commercially than we get from the average, well-constructed reciprocating engine working with moderate steam pressure, superheat, and vacuum. All these things considered, it is not unusual to find that the reciprocating engine can afford to be handicapped by an extra half pound of fuel per I.H.P. hour.

Practically the whole of the difficulties in the early days of turbine construction have now been overcome; therefore, quite apart from the running costs point of view, they are eminently suitable for the large units now demanded by the power stations. For ordinary works purposes they need not be considered up to 1,000 I.H.P., as it will be found that the reciprocating engine will be the best proposition in every way for this power and under. Beyond this figure and up to 2,000 I.H.P. they should be carefully compared, as they have the advantage in saving of space, cost of foundations, and housing.

As to the question of driving in cotton and woollen mills, without going into close detail I would like to remark that the value of the turbine is often reduced by unnecessarily turning the power into electrical energy, though it must be so if the drives are scattered. The electrical losses may be anything from 15% to 20%; therefore, where possible, the turbine should be fitted with a suitable reduction gear (now well tried) and rope drive applied to the shafts in the various rooms similar to the well-tried practice in use with reciprocating engines. In cases where process steam is required in addition to the amount necessary for power purposes, the position should be reviewed to see how far the exhaust steam from the engine or turbine working under a back pressure would satisfy the process requirements. If this is possible, 90% of the heat received from the boilers can be utilised. Should the steam be required for general process, the turbine will answer the case the best, as such exhaust will not be contaminated with lubricating oil.

As a typical example, we will deal with a case in which the power required is 1,550 I.H.P. and for process 46,500 lbs. of steam at 30 lbs. W.P. We will deal first with the engine or turbine as a condensing set supplied with steam at 170 lbs. W.P. superheated to a total temperature of 570°Fah. and the process steam generated in low pressure boilers at 30 lbs. W.P. Working under a 95% vacuum, the machine would have to be supplied with 20,900,000 B.T.U.'s of heat per hour, of which only 3,420,000 would be turned into useful work. The boilers would have to be supplied with heat at a rate of 27,400,000, which, at a boiler efficiency of 75%, corresponds with an hourly rate of fuel consumption of 2,175 lbs. with fuel having a calorific value of 12,600 B.T.U.'s per lb. With the same quality of fuel and boiler efficiency, the process steam would require a further 5,700 lbs. of fuel per hour. Therefore, for power and process the total hourly rate of fuel consumption would be 7,875 lbs. If the combined duty was expressed through a back pressure set, with steam having the same initial pressure and superheat, and working against a back pressure of 30 lbs. per sq. inch, the machine would have to be supplied with 57,320,000 B.T.U.'s of heat per hour, of which 3,420,000 B.T.U.'s would go to power and 52,644,000 B.T.U.'s to process steam, leaving the balance to be accounted for in the usual losses. The boilers would require 77,850,000 B.T.U.'s of heat, corresponding to a fuel consumption of 6,180 lbs. per hour. Comparing the results, the saving would appear to be 1,695 lbs. of fuel per hour. This, however, is hardly the case, for we still have to consider the capital outlay.

To begin with, it will be obvious that if the process steam had to be generated in separate boilers the pressure would be greater than 30 lbs., if for no other reason than to reduce the volume, as the pipe thoroughfares required would be in proportion to the relative densities. Hence, in considering back pressure installations, we must take into account cost of installation, cost of the large bore steam mains, valves, etc., necessary for the distribution of large volumes of low-pressure exhaust steam, insulation of surfaces, radiation; also that such steam is in a critical condition, and prone to condensation after passing through the turbine or engine.

All these points should be carefully weighed against the condensing set working under the best possible conditions, using steam at the same initial pressure and superheat as for power, reducing the pressure to that required at the particular process, or heating system, by passing same through small bore pipes, thus allowing the pipes to take over the function of reducing valves.

The extra heat necessary for the generation of the higher pressure steam is negligible compared with the saving in cost of installation, and if this is carried out correctly it would seem that the case for the back pressure sets is not so good as it appears at first sight. On the other hand, the exhaust steam might be a very attractive proposition if the heat could be transferred into calorifiers fixed close to the engine or turbine. In this way large volumes of hot water could be obtained and distributed in comparatively small bore pipes all over the works.

Another point to remember is that all steam, whether for process or engine purposes, should be superheated as much as possible, for the simple reason that the radiation losses are less than with saturated steam, and in this way a considerable saving can be effected when the pipe systems are very greatly involved. The steam pipe practice one usually finds in dye-houses, and the like, generally leaves a lot to be desired, the plumber or pipe fitter being allowed to guess the practice.

In ninety-nine cases out of the hundred such pipes are far too large for the steam they have to pass, resulting in waste in every direction, and the vessel or process only getting the benefit of 80% of the heat that it left the boiler with. It is not generally understood that steam will not flow without a drop in pressure, and as a pound of steam at 40 lbs. pressure practically contains as much total heat as a pound at 100 lbs. pressure it follows that the drop in pressure should always be taken advantage of. Thus, whatever quantity of steam could be passed through a given diameter pipe with a one pound drop in pressure, twice the amount could be passed through for a 4 lb. drop, and five times for a 25 lb. drop, and so on.

I cannot hope to deal fully with such a vast subject in a single paper, and can only trust that the foregoing will be of service in making it clear that if the elementary principles of steam and its practice were obeyed there would be less room for the involved plants so often suggested as avenues to economy. As a matter of fact, our steam and power costs are relatively no better than those obtaining in the days of our grandfathers; all that has happened is that our knowledge has increased in proportion to the cost of fuel and labour, and by applying such knowledge and adopting every known means for the efficient generation and use of steam, and reducing all possible losses, we are simply obeying the natural law of keeping in stride with the times.

In conclusion, let me refer you to the term "Conservation of energy." In every system the total energy, however changed, remains constant. This is shown by every fact we possess, and, although difficult to prove at times, yet its very rejection raises absurdities. Conservation of energy really means "Work put in equals work given out plus friction or loss in some form or other."

The Lecturer afterwards replied to several questions as to particular details of equipment in individual cases, and he said that moving bars had certain advantages and disadvantages which should be fully appreciated. He emphasised the importance of closest observation of the elementary principles which he had submitted.

On the motion of Mr. E. T. Holdsworth, seconded by Mr. Binns, the lecturer was warmly thanked, and in reply Mr. Hannan stated that he would be pleased to contribute further on the subject on some future occasion.

YORKSHIRE SECTION

Meeting at Bradford, 9th February, 1922, Mr. John F. White in the Chair.

NOTES ON OILS USED IN THE TEXTILE INDUSTRIES

By L. L. Lloyd, Ph.D., F.I.C.

Olive oil is used in the worsted industry because, of the so-called non-drying oils, it is among those obtainable in sufficient quantity and at a reasonable price; it is the most stable; and it has fewer objectionable properties than other non-drying oils. I have proved, however, that the free fatty acids of olive oil oxidise more readily than the neutral oil, the free fatty acids becoming almost completely oxidised by slow oxidation, before the neutral oil shows signs of oxidation. Neutral olive oil —that is, oil free from free fatty acids—will, however, become oxidised in a sufficiently long period, to form a viscous mass. This oxidation is aided by elevated temperature and the influence of direct sunlight.

The comber objects to olive oil of high free fatty acid content because it attacks the steel pins of the comb. This action is aided by the electrolytic couple formed by the steel pins and the brass setting, but this could be greatly reduced by the employment of a different method of fixing the steel pins whereby a couple would not be formed, and the life of the comb would probably be lengthened thereby.

The oxidation of olive oil is increased by secondary reactions in which the olive oil is decomposed into free fatty acids and glycerol. These decompositions are brought about by means of bacteria, fungi, and enzymes, all of which have access to the oil when distributed on wool in either wool or worsted material.

The author stated last year (This Journal, p.101) that tea seed oil was particularly liable to the production of faulty dyed pieces from a chemical and physical examination of the oil, which would lead to the production of oxidation and polymerisation products that would not be removed by ordinary scouring methods as applied to worsted goods. The bright and hot and lengthy summer of 1921 were factors which helped to cause the trouble, due to the use of this oil, that has produced so many faulty finished goods during last year.

The statement mentioned above, that the free fatty acids of olive oil oxidise before the neutral oil, is applicable to all oils; the more unsaturated the free fatty acids, the more readily will they oxidise. When one considers more readily oxidisable oils, however, the less is the relative rate of oxidation of the free fatty acids and of the neutral oil. Oxidisable oils, even in small quantities, when mixed with the non-dying oils, increase the rate of oxidation catalytically—that is, they act as carriers of oxygen from the atmosphere to the non-drying oils. Iron and copper are very active oxidising catalysts and even minute traces of these metals will have a detrimental effect on the oil on worsted. These metals may be easily carried into the yarn by frictional contact during the spinning operations.

Nut or Arachis oil, tea seed oil, or mixtures of these along with olive oil, are objectionable in the worsted industry, but good results are, and have been, obtained from the use of these oils. They should, however, only be used in self-contained works where the period from top to finished product is relatively short; they should not be employed on commission work where the conditions of storing and period from top to finished product is a very variable and unknown factor.

The defects on worsted piece goods due to the use of unsuitable oils are in many cases apparent in the goods in the grey state and often observable after the material has been scoured. In many cases, the effect may not be observable in the grey or scoured state, but becomes apparent only when the goods have been dyed. This is due to the difficulty of removing the oxidised oil by ordinary scouring methods, and, since the oxidation of the oil is not perfectly uniform throughout the material, it is rendered apparent by the difference in the penetration and absorption of the dyestuff and also in the different light-reflecting properties of various surfaces.

On material that has to be crabbed, the defect due to oxidised oil is increased; the action of heat upon the oxidised oil modifies its chemical and physical properties to a far greater extent than is the case with unoxidised oil.

Mildew, or other fungi, when developed on wool, modifies the properties of the material to a marked extent and particularly in regard to dyeing. Certain oils are also affected by fungi with liberation of free fatty acids and glycerol; the former will undergo changes due to oxidation and polymerisation much more readily than the neutral oil. A similar change is brought about by bacteria and enzymes. ...

Here is a field of research which would be of great benefit to the worsted industry. As far as the author is aware, few agents are employed as preventatives against these reactions, although a few compounds are used for treating yarn to prevent mildew. The author has carried out a number of experiments with a view to preventing or retarding oxidation of oils, and quite a number of agents have been found to be useful for this purpose; at present, however, these are only of scientific interest on account of other actions of these agents on the worsted whereby the dyeing and finishing properties of the material are too largely affected.

In connection with emulsifying agents (this Journal, 1921, 12, 101-2), it should be stated that wool creams are not objected to by the author unless a sulphated oil or other noxious products is employed in the production of these creams. It has been stated that if sulphated oil is a constituent of a wool cream, it will be sufficiently evenly distributed over the material prior to spinning to ensure level results. If this treatment were applied to one batch of wool for both warp and weft, the results should be satisfactory, but where different batches are used for warp and weft, an imperfect result will be obtained on account of the different dyeing properties of the warp and weft towards the majority of dyestuffs, and of different light-reflecting properties.

Many chemists object to the use of non-saponifiable oils in the wool and worsted industries because they are more difficult to emulsify and, consequently, are not readily removed by scouring. It might be pointed out that, in the wool trade, oil composed of equal parts of fatty acids and mineral oil is very largely used for oiling the wool prior to spinning. This mixture, or similar mixtures containing mineral oil, fatty acids and saponifiable oils, is completely removed by scouring woollen goods before dyeing or milling. Such mixtures of oils cannot be used in the worsted trade because the oil may become thoroughly oxidised on account of such thin films being exposed to the atmosphere. Mineral oil bleached or debloomed also undergoes modification on exposure to light and air, but not after chemical treatment to give a stable product.

Another neutral compound is worthy of mention; it is obtained by distilling neutral wool fat in superheated steam under reduced pressure. The distillation product contains olein (oleic acid) and higher melting point acids, along with a neutral product that is much more fluid than neutral wool fat but not as fluid as olive oil. This neutral compound may be easily emulsified; it does not oxidise on exposure to light and air, but is oxidised by neutral bichromate or, more readily, by acid and bichromate. It is, therefore, a product that may be used in either wool or worsted operations.

DISCUSSION.

Mr. W. Rushby asked what the Lecturer thought about olein containing 90% of fatty acids, which was very largely used.

The Lecturer said a distillation olein had not the same objectionable properties as the free fatty acids of olive oil. A distillation olein (oleic acid) had most probably a different chemical constitution to that of oleic acid existing as free fatty acids in olive oil. They could take, for example, the fatty acids in cotton oils, which oxidised so readily that there was a danger of fire; but if they distilled the cotton oil, there was no longer the same product. It was not the same as the original oil, and it was sufficiently stable to be used even in the woollen trade.

Mr. J. F. Barnes said he assumed that when Dr. Lloyd was talking about fatty acid he meant what was generally known as free fatty acid.

Dr. Lloyd said that was so.

Mr. Barnes suggested that if they used oil such as that referred to, containing 95 per cent. of fatty acids, it would surely attack the combs.

Dr. Lloyd said it would attack the combs similar to the free fatty acid in olive oil, but not to such a high degree if they used fatty acid along with an alkaline emulsifying agent.

Mr. Barnes said he meant if it were used alone.

Dr. Lloyd replied that in that case it would attack the machinery.

Mr. D. McLellan said that Dr. Lewkowitsch, in his book, objected to distilled oleines because they attacked metals, and said they ought not to be used for the finer goods. They had had several discussions in the dyeing trade about using oils, but the spinner seemed to take no notice. They took all the care they could in dyeing, but, if the oils were there, they caused bother. These fatty acids must have some action on metals. When they knew the fatty acids were in the cloth they could neutralise them, but a cylinder oil with fatty acids would attack the pistons and cause lots of trouble. There had been two discussions in the Huddersfield district on listed pieces, and it had all seemed to turn on the question of the use of oils by the spinner. It made him wonder why they did not adopt the French system of using no oil on the yarn. The French dyer had an advantage over the British dyer, because he was not troubled with oil problems.

The Lecturer, referring to Dr. Lewkowitsch's statement, said it was a fact that in the wool trade so many tons of oil containing fatty acids were used that he was afraid they would never get through the amount of work necessary without them; but he did feel that far too much oil was used. He did not think it necessary to add more than 7 to 8%, whereas from 13 to 15% was often used. So far as the finest class of woollen goods was concerned, they never got as good a result by using fatty acids as they did by using good olive oil.

Mr. McLellan thought the iodine absorption test was satisfactory for drying oils. He had had some tests which showed that linseed oil dried in twelve hours, maize oil in eighteen hours, and olive oil in thirteen days.

The Lecturer replied that he thought the iodine test was the best to use as a rough guide, but there should also be chemical tests extending over three or four days, with oxidation at a low temperature of, say 33° Cent. as a maximum. If they heated it at too high a temperature, some oils showed a higher oxidation value than they actually possessed when considered comparatively in the cold. For example, the addition of about half of one per cent. addition of linseed oil would not make any appreciable change on the iodine value but it would greatly affect the drying properties because it would itself oxidise and act as a catalyst.

A further question was raised with regard to the red deposit seen around the iron parts when certain oils were used. Was the deposit from the oil, or was it some free mineral acid? If so, how could they neutralise the mineral acid without turning the oil into soap?

The Lecturer said he did not think it was mineral acid. It was the fatty acid itself on the metal. It had formed an iron soap—a dirty red, slimy substance. It was due to a solution of iron in the fatty acid, which formed an iron soap layer on the metal.

Mr. A. Jaffe referred to the methods of judging the quality of oil, and suggested that after submitting the oil to an oxidation process for at least 24 hours at from 30° to 40° Cent., there should be a viscosity test.

The Lecturer said in that case the free fatty acid content would be modified by becoming oxidised and polymerised, and would show by volumetric analysis a smaller amount than before oxidation. The oxidised fatty acids would lower viscosity compared with a neutral oil and would lead to incorrect conclusions.

Another questioner asked whether there was any chance of getting a soluble oil that would be perfect both from the dyer's and the spinner's point of view—an oil that would be easily removed with the dirt. That would save the dyer a lot of trouble.

The Lecturer said he knew of a case in which soluble oils, because they were good penetrating agents, had been used to remove mineral stains. They had just rubbed the oil around the stains and so removed them. Thus they got a clean piece, but, when it came to dyeing, the part that had been so treated had resisted the dye altogether, or taken it up to such an extent as to make one of the most glaring faults possible. He did not think it practicable to use soluble oils so long as they followed the present methods of increasing solubility. If some other method could be found of making the oils soluble, he might favour it; but he preferred to use a good emulsifying agent—something that would dry evenly with the oil. Further, soluble oils would tend to cause the filling up of the card clothing and thus lead to other trouble.

Mr. J. F. BARNES asked whether the Lecturer would consider olive oil with 25% free fatty acid better for the woollen trade than one containing 2%. He looked at it from a scourer's standpoint. He had heard it said that olive oil was not so easy to scour out as a good oleine, with a good percentage of fatty acid. Was it not the trouble in Bradford that olive oil was more difficult to scour out than a good distilled oleine, with 70% free fatty acid up to 95%?

The LECTURER said he had come across troubles in the woollen trade due to the oxidation of fatty acid, with olive oil and 20% free fatty acid, but this only occurred where pieces had been left a long time in the manufactured state before being worked up. If they were not to be worked up quickly, they required a non-drying colourless or pale oil; when left for a long period there was a danger of getting films deposited on the material, which would be very difficult to remove. There was not the same danger in the woollen trade as in the worsted trade, owing to the large amount of oil present. The conditions were different in the woollen trade. If they used oils there, preferably containing a good quantity of free fatty acid, there was no objection to it.

Mr. FRANK HARTLEY asked what was a fair standard of acidity for the Bradford trade. They had talked about 25%, 20%, and 75% in oleines, but what was a fair standard for olive oil from a combers' point of view?

The LECTURER said 3% could be taken as a round figure, but there was more in it than that. Some research body ought to go into the matter of acidity from the point of view of preventing mildew, the growth of fungus, and bacterial products. They caused any amount of trouble, and it was a matter that required investigation. The Textile Institute might push it with advantage.

Mr. HARTLEY said he did not think they could get olive oil with 3% of acidity. It was generally nearer 6 or 7%. If they could get 3% it would be worth from £1 to £2 per ton more.

The LECTURER contended that in the worsted trade olive oil was not used for all the purposes for which it should be used. He believed the dyers would be satisfied and half their troubles would be removed if pure olive oil were used to a greater extent. Unfortunately, however, there were many "fakes," and oil merchants were very handy at mixing.

In reply to another question, he said the addition of mineral oil to fatty acid improved the oil and reduced the degree of oxidation. The oil content was mixed and spread over the material to the same degree; consequently the mineral oil could not separate out and finally would be removed by scouring.

Mr. C. P. TATHAM referred to a difficulty which had arisen in pieces woven from dry-combed warp and oil-combed weft. There were streaks of variable width.

Mr. C. E. BUTLAND referred to a similar difficulty and the probable cause of it was discussed at considerable length, particularly with regard to brown threads appearing intermittently in cream goods.

One member suggested that oil stains were the cause, and that they might have been thrown on to the warp from the tappet nose. Another suggestion was that mineral action had been set up from the healds through the pieces being left standing in the looms in consequence of short-time running. The faults did not occur where the loom was kept going, and they might have occurred through the cloth being left in the loom for a considerable time.

Mr. BUTLAND referred to the importance of dealing with these problems from the raw material stage right through to the finished article. A similar idea had been expressed at a recent meeting of the Society of Dyers and Colourists. Why should not the textile societies get together and have a meeting representing combers, spinners, manufacturers, and dyers, for the purpose of dealing with these problems on proper lines?

The CHAIRMAN (Mr. J. F. White) said that one of the objects of the Textile Institute was to bring the various sections of the trade together. They desired to co-ordinate the work of the various societies and associations throughout the industry. It was becoming more and more important that the views of the dyers, combers, spinners, manufacturers, and others should be expressed through one Journal, so that each could understand the other's point of view. People in the cotton trade ought to know what was taking place in the woollen and worsted trades, and vice-versa, whilst it was important that both should know what was going on in the flax and silk industries. It was only by coming together that they realised how closely allied were the various sections of the textile industry. They did not meet together merely to discuss matters of interest to Bradford and Halifax, and so on. They were dealing with matters affecting the textile trade of the whole of the United Kingdom. The more they got together, the better would the results be.

Mr. WARD PARKINSON, in moving a vote of thanks to Dr. Lloyd, said that the Bradford Textile Society had been considering exactly the same idea as that mentioned by the Chairman, and they were looking to the Textile Institute to give them a lead. He felt sure that the textile societies concerned would willingly co-operate. They were out to secure the best interests of every section of the trade, and it would be a good thing to bring together the comber, spinner, manufacturer, and dyer.

Mr. HEPWORTH, in seconding the vote of thanks, said that although he had been in the trade forty years he was always learning something. So long as he had been in business there had been difficulties with regard to bars across the piece. Some said it was a chemical fault, and others a mechanical fault. Let them get together and settle it. It would be a great advantage to the trade if they could have a joint committee representative of the whole of the sections to deal with defects.

NOTES AND NOTICES

NEW MEMBERS OF THE INSTITUTE

At a meeting of the Council of the Institute held at Manchester on Tuesday, 25th April, the following applicants were elected to membership:—E. McKenzie Taylor (Cairo, Egypt), A. M. Tenney (New York), R. G. Parker (London), W. Hilton (Japan), G. Sutcliffe (Castleton), K. Toyoda (Japan), F. J. Harlow (Blackburn), C. E. Anderson (Mossley), D. G. Choudari (London), J. R. S. Goodall (Radcliffe), W. A. Firth (Hyde), A. E. Lewis (Manchester), Hugh Findlay (representing Messrs. J. & P. Coats, Ltd., Glasgow), J. Macadam (Wilmington, U.S.A.), and D. S. Ashbrook (Wilmington, U.S.A.).

THE COTTON SETTLEMENT.

Another awkward corner has been turned in the cotton trade, and employers and workers alike are to be complimented on settling their differences without resort to the harsher methods of strike or lock-out. No one minds how fierce the fight round the council table—the thing is to keep it there. Once it makes its way into the open, confusing issues too often creep in, and the spirit of bitterness is fostered. Unchained passions are not easily whistled to heel again. Therefore, it is well that the cotton industry has got back to the methods of discussion, concerning which it has established fine precedents. What now is needed is not so much to analyse the terms of settlement but to look forward to the future and to find ways and means of co-operation. The cotton trade has had a bad time of late, and, although there are signs that the corner has now been turned, it will have to work and work hard in order to build itself up again to its former pre-eminence. It has all the materials at hand for doing so—skill, its inherited traditions, its faculty for adapting itself, and, not least, the new lines on which it is striking out by the establishment of a research institution and the technical advances being made by the finishing sides. The exhibition recently held at the Textile Institute was a splendid object lesson of what the textile industries can do. The exhibits were mute but unshakeable witnesses, proclaiming that the optimism to which Mr. John Emsley, the new President of the Institute, confessed was not without solid foundation. —R. C.

RENEWALS OF MACHINERY

Quite legitimate speculation has been aroused by the announcement that half a dozen or so of the most prominent engineering firms of this country had entered into some sort of combine, along with the Prudential Assurance Co. It is, indeed, the presence of the latter company in the combine that gives real interest, not to say piquancy, to the announcement. The explanation is, so far as can be gathered, that the combine is no more, though still important, than an arrangement which will help the financing of big contracts without the constituent firms having to increase their capital. It has a bearing on the textile industry. In this industry, it is stated, something like 80% of the firms are two years behind with their normal repairs and renewals of machinery, and if that work could be financed it could be put in hand early and provide employment for this section of the engineering trade; in fact, a number of firms could go on full time and keep running for two years at this pitch. This, if true, is distinctly encouraging. Work for textile machine makers in the home trade means a healthy textile industry, and that is a state of being many wish to reach. New and modern ideas in machinery, new and scientific methods of manufacture and finish—these are the things that will keep us ahead of the world. —R. C.

FUSION OF RAILWAY UNDERTAKINGS.

It is doubtful whether the Railways Act, 1921, contemplated such a fusion of interests as is now going on, and the commercial world will watch the development to see what the effect will be upon industry. For that there will be further developments may be regarded as certain. The denial issued when the proposed fusion of the new L. & N.W. and the Midland was reported deceived no one who was following the trend of events. With that fusion now a moral certainty, it may easily be guessed that other companies in the same group will eventually be absorbed and we shall have one consolidated concern for the whole of that particular area. Similar action is going on in the Western group, and there are signs of it in others. What is to be the end of it? Shall we see eventually, though perhaps not for some years, one great railway trust for the whole of Great Britain, with an enormous capital and tremendous powers? In that case, what will be the position of the commercial community? On that score, the fear is much less now than it would have been some seven or eight years ago. The companies have now strong opposition to face—opposition of a kind they cannot with advantage fight if that opposition is so minded. We may be sure, then, that economic conditions will oblige them to give the best and cheapest service they possibly can. Broadly speaking, the situation may be summarised thus: With regard to passenger traffic, what was normally the travelling as distinct from the holiday travelling public, can now run motor cars, and will turn to cars if fares remain high. This leaves the companies the excursion traffic, and here again there is competition in the shape of the motor coach. Cheap fares are therefore economically certain. In the sphere of industrial haulage, the permanence of high rates will drive all but the smallest of concerns to operate their own motor vehicle or fleet of vehicles, and they will find that it will pay them to do so. Economic circumstances again, therefore, will act as a check upon any high rates policy that may be desired by the companies. Amalgamate and fuse as the companies will, the public has now an alternative system of travel and haulage, and the companies are very well aware of it. That fact should keep them to a constructive policy. —R. C.

ASSISTANT, with experience of textile manufacture and testing, and some knowledge of physics or chemistry; University man preferred.—Address, Box 20, The Texile Institute.

LINKS WITH AUSTRALIA.

The visit of the Australian deputies to the port of Manchester is a tangible evidence of the growth of the movement for linking up that port with the Dominion. It has been slow of development. Vested ideas have stood in the way, but at last it is being acknowledged that Manchester has the entrance—the new tradesmen's entrance, as it was aptly put—not only to a big population who need foodstuffs, but also to the cotton and woollen industries. In these days, when every little item of cost is worth consideration, it is not creditable to the business community that wool, for example, should be shipped to London and then transhipped to Bradford, when a modern port, fully equipped with facilities, is no more than fifty miles away. That fifty miles is spanned by direct railway communication, and also, what is of even greater consequence, it is well within the economic radius of the modern commercial motor vehicle. Some start was made during the war in establishing Manchester as a port for the entry of wool, just as of late efforts to make it the port for cotton have won some success. There are geographical, financial, and economic reasons why cargoes from Australasia should be shipped to Manchester port, and sooner or later those reasons will tell. There needs to be an understanding on the other side of the world what can be done at the port, and on this side a better understanding of the needs of Australasian producers. The visit of the delegation should do a great deal to bring these points of view together. —R. C.

GENERAL ITEMS AND REPORTS

HYDROGEN PEROXIDE BLEACHING.

Mr. H. Wilson gave a lecture on "The Manufacture and Application of Peroxide of Hydrogen" before the Huddersfield Section of the Society of Dyers and Colourists, on Thursday, March 9th. Dr. L. Gordon Paul presided.

Mr. WILSON said the great advantage of hydrogen peroxide over all other bleaching agents was that the liberation of oxygen simply left water behind. In recent years great progress had been made in its manufacture by the electrolytic process, and it was now available in a 30% concentration, equivalent to 100 volumes, as against the 10 or 12 volumes formerly available. This electrolytic hydrogen peroxide was being made in Switzerland by water power, and, although the actual process was secret, he was informed that it consisted in the production by electrolysis of per-compounds of sulphuric acid or its alkaline salts, the hydrogen peroxide then being distilled off. A product of great purity was produced, which was very stable and almost non-decomposing. It could be heated to 90° C. without decomposing. The fact that only one carboy had to be handled in place of eight or ten of the ordinary quality saved a great deal in storage and transport, whilst it kept its strength almost indefinitely. Hydrogen peroxide was used in the textile trade for bleaching all kinds of materials. The solution used was usually slightly alkaline. The more alkaline the solution, the more quickly it decomposed. All vessels and cans should be scrupulously clean, and it was essential to avoid traces of iron, copper, or magnesium in the vessels or on the material itself. Hydrogen peroxide could also be used after chloride of lime bleaching, when it acted not only as a further bleach but as an antichlor, preventing tendering of the fibre and ensuring more level dyeing. In wool bleaching, the wool should be as clean as possible, and the usual way was to steep it from twelve to twenty-four hours in a bath containing a dilute solution of hydrogen peroxide made distinctly alkaline with ammonia or silicate of soda. The speed of the process could be increased by raising the temperature and increasing the alkalinity. The peroxide bleach was used not only on white goods, but on wool yarn and pieces which had to be dyed in pale delicate shades.

In the course of discussion, Dr. PAUL said he was glad to hear that the new product was so stable.

Mr. C. E. BARRACLOUGH said he was accustomed to use a cold bath for bleaching worsted goods, leaving the pieces in overnight. That was the most economical way.

The LECTURER said he agreed, but most firms preferred to run their process more quickly.

DEPARTMENT OF AGRICULTURE, BRITISH EAST AFRICA.

The annual report for 1917-18 contains notes on sheep rearing, fibre crops, including sisal and flax, and on kapok (*Eriodendron anfractuosum*). There is a chapter on the experiments in the cultivation of silk. The Eri silkworm which feeds on *Ricinus communis* (castor oil plant), the mulberry silkworm and indigenous silkworms have all been experimented with. In the case of the first, the apparatus necessary and the methods followed are briefly described. Since the silk of these caterpillars cannot be reeled, it is spun and woven in the same way as cotton, and can be made into strong, durable cloth which takes dyes easily.

Three diseases of sisal are described, and one of these is identified as being caused by a species of *Colleotrichum*, spots being produced on the leaves. It does damage to the fibres. A *Macrosporium* causing a disease on flax stems is described briefly.

—W. R.

REPORT OF DEPARTMENT OF AGRICULTURE, PUNJAB, 1921.

The report describes a very large number of experiments with cotton and other crops. These included varietal, manurial, and irrigation tests. The results are given in detailed tables, and with these are reports on the various varieties grown, from spinners' and graders' point of view. —W. R.

REPORT OF DEPARTMENT OF AGRICULTURE, BOMBAY, 1920.

The report summarises the progress made in introducing the four strains of improved Surat 1A. cotton, deals with other varieties tested, and with the work of the plant breeding expert. The work of the various institutions of the Department is described. In many cases, work on cotton is included. —W. R.

REPORT OF AGRICULTURAL DEPARTMENT, BIHAR AND ORISSA, 1921.

The work of the year is passed under review. In certain districts, cotton has been introduced for trial and selection work continues on cotton at Ranchi and at private farms in the Santal Parganas. —W. R.

SOCIETY OF DYERS AND COLOURISTS.

The annual meeting of this Society was held at Manchester on the 31st March, the President (Mr. H. Sutcliffe Smith) occupying the chair.

The twenty-eighth annual report of Council, which was adopted, reviewed the work of the Society during the past year, and presented a short digest of the papers read before the various Sections. Satisfactory progress is reported to have been made with the colour index which the Society is to publish, and it is anticipated that the first number will be issued at an early date.

Mr. Sutcliffe Smith was re-elected as President, and Messrs. F. J. Farrell, E. Hickson, and Prof. E. Knecht as Vice-Presidents. Prof. A. G. Perkins, Mr. F. E. Craven, and Mr. H. Jennings were re-elected as members of Council; Mr. J. R. Denison as Hon. Treasurer, Mr. A. Silverwood as Hon. Secretary, and Mr. W. P. Thompson as Hon. Patent Agent.

The annual dinner was held at the close of the meeting, Mr. Sutcliffe Smith presiding over an attendance of 170 members and guests. Amongst the guests were Sir Philip Lloyd-Graeme, K.B.E., M.C., M.P. (Board of Trade), Brig.-General Sir William Alexander (Chairman, British Dyestuffs Corporation, Ltd.), Mr. W. J. M. Woolcock, M.P. (Chairman, Dyestuffs Development Committee), Col. F. R. McConnel (President, The Textile Institute), Mr. W. Clare Lees (Manchester Chamber of Commerce), and Mr. Percy Ashley, C.B. (Board of Trade).

In the course of his remarks in proposing the toast to "The Society of Dyers and Colourists," Sir Philip Lloyd-Graeme said the dyestuff industry carried a great responsibility upon its shoulders, and a great future was before it. There seemed to be hardly any field of enterprise into which dyes, directly or indirectly, were not likely to enter. Not only were they vital to the textile industry—the greatest industry of this country—but they were likely to be of still greater potential value should we be faced with war in the future. There was one aspect of the Society which seemed to him to be one of great value and promise. In it both the makers and the users of dyes met on a common ground to study common problems and to pursue a common purpose.

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PROCEEDINGS

SOUTH OF SCOTLAND SECTION

Meeting at Technical College, Galashiels, 17th February, 1922, Mr. J. Hutcheson in the Chair.

STEAM PRODUCTION

By J. A. Turnbull, A.M.I.M.E.

Combustion of Fuel in Boiler Furnaces, and Heating Efficiences of Fuel.—When the carbon and hydrogen in the fuel combine with the oxygen of the atmosphere, carbon dioxide and water are formed if the combustion of the fuel is complete. These conditions are seldom fulfilled, and fuel escapes unburnt. Carbon and oxygen combine to form carbon monoxide, and the heat given out is about one-third of the amount when combustion is complete. This is due to an insufficient supply of air. A good draught is necessary, and although the first cost is high it is cheapest in the end, necessitating a good height and area of chimney. Draught may be either induced or forced. The area between the fire bars should allow of an ample supply of air, but not so wide as to allow the fuel to fall through unburnt. Some grades of coal when first put into a furnace distil very rapidly, giving off the volatile gases too fast for the available supply of oxygen. This is usually noticeable by black smoke. It is then necessary to admit more air through the fire door on to the top of the burning fuel, but this temporary admission of oxygen should be stopped as soon as the excess of these hydro-carbons is burnt, so as to avoid cooling down the fire. Generally speaking, steam boilers burning large coal are more efficient than those burning small. The state of the brickwork is most important as any air entering the flues reduces the temperature of the flue gases and the draught. The calorific value of best steam coal equals 15,300 B.T.U., of coal gas 21,000 B.T.U., and of oil fuel 19,200/22,000 B.T.U. per pound. Of air, 17 to 19 lbs. are required per pound of coal (but often as high as 20 to 30). By test, 12 lbs. of water were evaporated per lb. of coal burnt from and at 212 deg. By the calorimeter, 14 lbs. of water per lb. of coal was shown. The efficiency in the test, therefore, was 87%. The loss in efficiency is only 13%, which is very small. The result is rarely attained, and, in general conditions, a furnace is doing very well with from 65 to 80% efficiency. In the purchasing of coal, oil, or other fuels, I should recommend buying on calorific values and not on some such terms as steam breeze, etc. Steam boiler plants should be supplied with water meters, and separate records kept.

Removal of Waste Products of Combustion.—In the case of ordinary fuel, these consist of ashes and soot; in oil or gas-fired boilers there is no waste product and thus considerable saving is effected as compared with coal. Soot can be considerably reduced by careful firing. Soot is unconsumed carbon and is difficult to remove from the boiler plates and flues; because of its non-conducting properties, its presence is objectionable, and more coal is required to keep steam up. To remove this deposit, mechanical appliances have been introduced. These consist of internal blowers in the flues, worked by compressed air or superheated steam. Dry soot is not mechanically injurious, but the moment moisture gets to it the contained sulphuric acid attacks the plates. Fuel gases deposit soot, sulphuric acid, and ammoniacal salts. The quantity of soot deposited depends on the strength of the draught. The greatest deposit is usually found in the base of the chimney, where it is more or less harmless.

The heating efficiency of steam boilers resolves itself into the quantity of heat per square foot per degree of temperature transmitted per hour from the fuel to the water. The heating surfaces should be arranged to extract the maximum heat from the fuel. In Lancashire and Cornish steam boilers, the heating surfaces of the furnaces perform nearly all the evaporation, whilst the side and bottom flues assist the circulation; in the Gallaway boiler, this is more marked than ever as the tubes are at right angles to the passage of the flue gases.

Means of Preventing Condensation between Boilers and where the Steam is to be used.—Condensation can be reduced by covering the steam pipes with some non-conducting material. To prevent loss of heat from steam pipes, &c., they should have an air space immediately surrounding them, hermetically closed, and asbestos covering put on the top. Super-heating is used to reduce the initial condensation in the engine cylinders by imparting additional heat after the steam leaves the boiler. This is usually obtained from the waste heat of the gases, by placing a series of pipes in the boiler flues. The variation in lengths and diameter of pipes, in pressure and temperature of the steam, in temperature of the atmosphere, the quality of the non-conducting material, and covering exits, are all factors difficult to focus in formula. In a test after the steam had travelled 1,750 feet, it was found that the additional temperature due to super-heating had vanished, but the condensation in transmission had been provided for without any additional expenditure of fuel.

The principal drawback to adoption of super-heating has been the difficulty of lubrication, now largely overcome by the introduction of the hydro-carbon oils having a high flash point, and also by forced lubrication to the valve surface by means of oil pumps. Super-heaters are usually constructed of mild steel of great tensile strength, easily accessible for cleaning, repairs, inspection, and provision is made for cleaning the tubes when the boiler is under steam.

The steam inlet and outlet to and from the super-heater should be independent of the covers of the super-heaters, so as to avoid removing the steam pipes to obtain access. There are two types—(1) super-heaters placed in the path of the boiler flame, and heated with the boiler gases; (2) super-heaters which are built up and fired separately.

It is advisable where possible to attach the super-heater to the boiler for economy and uniform super-heat. A separately-fired super-heater will give a very high degree of super-heat; with a constant supply of steam, it will be fairly uniform, but where work is irregular it is not suitable as it is liable to a considerable variation in temperature, and considerable heat is wasted as the temperature of the gases leaving must be in excess of super-heated steam. Tests have shown that there is little difference in the temperature of the feed water as it leaves the economiser, due to the fact that when super-heated steam is used a large percentage of steam is affected, and there is a saving in water, so that although less heat is available for the economiser there is less water to be heated. Copper and phosphorus bronze pipes should be avoided, as these deteriorate under the action of the super-heated steam. Steel and cast-iron pipes do not seem to be affected. The gain from super-heating will not be less than 10% saving in the coal bill, and where conditions are favourable this gain reaches from 20 to 30%.

At a cotton mill, after fitting the boilers with super-heaters, four boilers were found to do the work of five. In a mill where one of the boilers was used entirely for heating, in cold weather additional steam had to be supplied from another boiler. When a super-heater was fixed to the boiler, the heating was much better done without any assistance and on Monday morning the desired temperature was reached by the time work was commenced instead of at noon. Great progress has been made in super-heating within the last ten years, and the mechanical difficulties have been entirely overcome. There is now practically no expense in repairs, and in the near future super-heaters will be largely adopted by manufacturers. By super-heating steam its volume has been increased only in the ratio 9 : 10. Though an efficient super-heater will deal with wettest steam and supply it dry, it is very important that it should receive the steam in the driest condition, on account of the solid matter carried over by the moisture impairing the efficiency of the heating surfaces and reducing the durability of the super-heater.

Method of Utilising Waste Heat from Boilers.—The total heat transmitted from the coal to the water is 80/84% in well-appointed plants, and as low as 35/40% with badly arranged boilers. It is not advisable to reduce the temperature of the waste gases below a certain figure, as some heat is required to produce the chimney draught, but with up-to-date methods of extracting the heat sufficient remains to produce the draught, provided the chimney is properly designed, and the lowest temperature of waste gases should be about 300 degs. The most economical method of extracting the heat is by means of an economiser. This consists of a set of pipes set vertically in a chamber in the main flue. The hot gases come in contact with the outside of these pipes through which the feed water enters the boiler, and the saving in fuel averages from 10 to 25%. The benefit depends on the type of steam boiler, the fuel consumption, the temperature of the waste gases, and the capacity of the economisers in proportion to the amount of water evaporated, the position of the economiser with reference to the boilers, and the space available in which to erect the economiser. The usual average temperature of the waste gases leaving these boilers is from 600 to 800 degs. The feed water should never travel faster than 2 feet per minute. With a Lancashire boiler 30ft. by 8ft., evaporating say 7,000-8,000 lbs. of water per hour, it will be usual to have an economiser with 120 to 160 pipes, and the outlet temperature should not be less than from 280 to 300 degs. The advantage of having an economiser sufficiently large is that when the mill stops work at night and the boilers want filling up, there is an ample supply of hot water available from the economiser which lasts all night.

Very much depends on how an economiser is worked and looked after by the attendants. To get good results, a constant speed of water should pass through the economiser. The regulation of the draught in a battery of boilers and economisers should be by a main damper at the base of the chimney; it is much easier for the attendant to regulate the draught under these conditions. The top of the economiser should be covered with movable asbestos mats, as any permanent covering has to be removed and replaced whenever an economiser is examined. The pipes should be kept free from soot by means of scrapers worked by chains and gearing. With "hard" feed water the interior of the economiser pipes gets encrusted; to prevent this, it is necessary to have a water-softening plant, or provide for injecting into the feed water a soda ash solution to prevent the formation of scale. The draught required where economisers are used varies from ½ inch to ¾ inch, and where the plant is a large one 1 inch on the water gauge. Sometimes, the lower parts of the economiser deteriorate, due to feeding cold water, thus causing condensation on the surface of the pipes. This with the sulphur in the soot sets up sulphuric acid, which eats the pipes away. Feed water should never be less than from 90 to 100 degs. temperature. The saving by using an economiser may be divided into two parts—(1) the heat actually recovered; (2) the increased evaporation per lb. of coal, because the saving has permitted a lower rate of combustion, while the quantity of steam given out has been the same as previous to the installation. In an example, the water after passing through an economiser was heated from 59 to 290 degs., and the boiler pressure was 120 lbs. per square inch; the evaporation from and at 212 with the economiser working was 11·23 lbs. of water per lb. of coal, and without the economiser only 8·29 lbs. of water. Therefore, the actual saving was 26·18%.

The general advantages of using flue gas economisers are :—(1) Increase of steaming capacity; (2) saving in repairs; (3) prolonging the life of a boiler; (4)

saving in cleaning of boilers; (5) where the work demands from the steam plant sudden fluctations.

In conclusion I should like to mention that I am indebted to the following firms for lending me lantern slides and diagrams :—The National Boiler Insurance Co., Messrs. Sugden & Co., Ltd., Messrs. Galloways Ltd., Messrs. Thomsons Ltd., Messrs. Babcock & Wilcox, Messrs. E. Green & Sons, Ltd., and Messrs. Stirling Boiler Co., Ltd.

I hope to continue this lecture, and the next part will consist of types of steam boilers and their construction, boiler fittings and scientific appliances applicable to boiler plants both of new and of old types with the object of showing how the highest efficiency may be obtained from them.

DISCUSSION.

In reply to questions by Mr. Gibson, the Lecturer said that the difficulty of the use of super-heated steam with Corliss valves was perfectly overcome with forced lubrication. It did not pay to have super-heated steam for heating only, unless there was a considerable distance through which it had to be transmitted. For heating purposes, it was much better to use exhaust steam from the engine. He did not recommend super-heated steam for a dyehouse. The dyehouse would be almost certain to be close to the boilers, and low-pressure steam would give out not so much less heat.

LANCASHIRE SECTION.

Meeting at Technical College, Blackburn, 25th February, 1922, Mr. James Smith in the Chair.

THE FUTURE OF THE COTTON TRADE.

By W. Greenwood, M.P..

In the course of a lengthy address on the above-named subject, Mr. Greenwood said that attending Blackburn to talk about the cotton trade was somewhat like carrying coals to Newcastle. The existing situation could perhaps be best described by saying that it was indescribable. Those in it were not in the fortunate position of some men who were in it but had got out of it. Looking at what was taking place in that College and witnessing the marked interest taken in technical education in Blackburn, he realised that in that district they were not only in it but determined to make the best of it.

Consideration of experience of the past was useful in regard to what we did at present and to what we might look for in the future. And he often wondered whether at present we did not attach too much importance to the trade already secured and the retention of it compared with the importance attached to the pursuit of new markets. There was probably too great a tendency to remain in a groove, and he did not think this tendency was confined to workpeople. Some people seemed to take it for granted that to produce certain goods regularly even at a loss was better than irregularity at a profit. To be too conservative might mean the loss of new markets. In these days, it behoved everyone to do everything possible to get a move on. The slump in trade was the biggest experienced for 50 or 60 years and it was not anticipated. Some people said it had caused dislocation of all the markets and exchanges. He wanted to say that he did not think the slump was absolutely essential as an after-war effect, and he was not speaking in a political sense. He believed it was brought about by this nation in 1920 taking up an attitude of excessive deflation and imposing a wrong system of taxation. Our policy brought about lack of confidence in the business world which brought deflated values and collapsed exchanges. Two years ago when everyone was working, the exchanges though not normal were very steady, and the countries of the world were buying one from another. Now we were in the position of being in a bog; a move must be made and that cautiously until more solid ground was reached.

With regard to existing markets, he felt there was no fear of losing them because of lack of attention to the technical side of the industry, judging by the interest taken in the work at that college and the esteem in which the individual in charge was obviously held.

As to markets, it was possible to dwell too much on the drop of exports to a particular country, and the broadest outlook should be brought to bear in considering export returns. Every fall should be considered and effort made to ascertain the cause. Trade ought to be a *quid-pro-quo* movement. Suppose we were getting all the cotton we required from America, what about Empire cotton growing development? There were two reasons why that development should be encouraged; first, to provide against risk that in normal times the supply might fall below the requirements, and, second, that when you develop other fields, especially within the Empire, useful reciprocal trading may follow. Trade follows trade, and in considering new markets, we should take a long view. He had not heard of anybody who understood political economy, and the wisdom of providing in the full years for the lean ones, better than Joseph in Egypt. Although we were faced with a probable crop of eight million bales of cotton, yet there was hardly a single spinner in Lancashire who did not think there was plenty to go round and no need for alarm. If there was plenty, it would be due to loss of normal demand. In this matter there was real danger of omitting the long view.

With regard to scientific research for the cotton industry, he was afraid that if the movement for adequate provision had not been started two or three years ago, it would have had little chance to-day. The establishment of the Cotton Research Association was a hopeful sign for the trade and he believed it would prove to be one of the best assets of the industry. If the industry has to have, as he believed it would have, a brilliant future, then we must get rid of the idea that we can afford to dispense with science as applied to the industry.

The time to look for new business is when you are slack. That morning he had witnessed 15 loads of cotton machinery going to India. We must not be surprised at India developing her cotton resources. Sometimes, in Lancashire, the idea prevailed that a humid atmosphere was everything that mattered. Yet whilst in the Pyrenees recently he saw 40 frames at work all spinning 140's cotton!

Industrial welfare work was a movement which needed encouragement. Developed on reasonable and sound lines, great good would accrue, but here again immediate results should not be regarded as the test.

Finally, Mr. Greenwood said there was still a great future for the cotton industry of this country.

VOTE OF THANKS.

Mr. J. Taylor moved a vote of thanks to Mr. Greenwood and the Chairman, and said we were perhaps rapidly getting to the stage at which future progress would be governed by the measure of co-operation between not only the spinner and the manufacturer but also between these and dyer, printer, and finisher.

Mr. D. M. Hollins seconded, and said he would like to endorse Mr. Greenwood's observations as to the need of the long view. The short view was often associated with the get-rich-quick idea, the prevalence of which in 1920 had probably a great deal to do with the existing depression.

The vote was heartily accorded, and after the meeting Mr. Greenwood, M.P., and others inspected the textile department of the College.

NOTES AND NOTICES

THE INSTITUTE AND TEXTILE SOCIETIES.

Representatives of this Institute and of various Textile Societies in Lancashire and Yorkshire have recently conferred together with a view to arriving at possible means of co-operation and of avoidance of overlapping in regard to the delivery of lectures in various districts. The Institute appointed a sub-committee to consider the matter and it was decided to call a conference in order to provide opportunity, in the first instance, for free interchange of views and opinions as to possibilities. After the first general conference, sectional meetings were arranged and held at Bradford and Manchester respectively. A second general conference took place at the Institute rooms on Saturday, the 28th May, when the President of the Institute (Mr. John Emsley, J.P.) occupied the chair. The President expressed the personal hope that in the near future some means of affiliation of textile societies with the Institute might be secured, and the suggestion met with a substantial measure of expression of approval. It was urged, however, that the movement for co-operation would be more likely to develop on a really satisfactory basis if it were allowed to proceed slowly at the outset. The conference decided, therefore, for the present, to confine attention to (1) co-operation in regard to arrangement of lectures, (2) provision of arrangement of one or two joint meetings for Institute lectures in the course of each session, and (3) preparation of a panel of lecturers, such panel to be contributed to by Societies and by the Institute, and establishment of a joint committee or committees to deal with the matter. The conference decided that committees should be called for Lancashire and for Yorkshire to proceed with the formation of a panel of lecturers.

A LEADER IN THE COTTON INDUSTRY.

A great loss has befallen the cotton industry by the death of Mr. John W. McConnel, chairman of the Fine Cotton Spinners' and Doublers' Association, chairman of the Empire Cotton Growing Corporation, and principal of the firm of Messrs. McConnel & Co., Ltd., Ancoats, Manchester. The deceased gentleman was a member of the Textile Institute and from time to time had served on various committees. He was a man of quite outstanding ability and attainment, and it has been said with every justification that he was one of the few leaders in the cotton industry possessed of really statesmanlike qualities. Firm in his convictions, Mr. J. W. McConnel acquired strength by his very reserve and unobtrusiveness. His sincerity of attitude was never open to the smallest doubt, and he avoided rather than sought mere popularity by figuring in the public eye. He took the warmest interest in movements which really mattered so far as the cotton industry generally was concerned and put a vast amount of energy into any movement of consequence with which he became associated. Mr. McConnel belonged to a family which took no small part in the laying of the very foundations of the Lancashire cotton industry. Widely-travelled, he was one of the survivors of the loss of the Lusitania, and it is possible that the shock of that experience may have shortened his life.

EXHIBITION OF YARNS AND FABRICS.

In reference to the recent exhibition of yarns and fabrics, organised and held at the Textile Institute, the question has arisen as to whether the promotion of such an event may be contemplated as an annual event. That the exhibition was interesting and useful is not in the least doubtful, and the attendance on the four clear days on which it was open to visitors connected with the industry was more than satisfactory. The committee concerned with the organisation of the fixture has considered the matter of recommending that the fixture be made annual, but with a view to further guidance the views of exhibitors themselves have been sought. The replies received from exhibitors are, for the most part, of an encouraging nature. There is considerable diversity of opinion, however, on several important matters. Some exhibitors are decidedly in favour of an annual exhibition, whilst others have concluded that a longer interval than one year is advisable. Again, it is suggested by several exhibitors that better accommodation—a larger hall—should be secured for the fixture, whilst in one case, on the other hand, it is urged that the bringing together of a large variety of products within a small area is a distinct advantage to visitors. The whole subject will probably be discussed at next meeting of the Council of the Institute when a report in regard to the Exhibition will be presented. Some time ago, a member of the Committee suggested that an exhibition held annually in different centres visited at the time of Institute Conferences might prove a highly useful enterprise, and the suggestion is not likely to be overlooked, though the expense might be a serious consideration.

NOTTINGHAM AND THE TEXTILE INSTITUTE.

A few years ago, a successful Institute Conference was held at Nottingham. Although comparatively little progress has been effected in the upbuilding of membership of the Institute in the Nottingham area, yet it is a source of satisfaction that close touch is maintained with various organisations. For two years in succession, at the request of the Federation of Lace and Embroidery Employers' Association, the Institute has undertaken the supply of a lecturer on the occasion of the annual meeting of the Federation. Last year, Mr. J. Winterbottom, of the Manchester College of Technology, attended on behalf of the Institute, and lectured on yarns, whilst this year (on the 18th May) Mr. P. E. King, of Leeds University, contributed a lecture on "Artificial Silk and its Applications in the Textile Industries." The Institute has since received from the Secretary of the Federation (Mr. Gregory Meakin) a letter expressing warm appreciation in regard to the Institute's co-operation in the matter. At the annual meeting referred to, Mr. W. H. Carey was elected President of the Federation for the ensuing year in succession to Mr. A. Tunnicliffe, whilst Mr. H. Grundy was elected Vice-President.

THE LATE SIR WM. CRAWFORD, J.P.

Sir Wm. Crawford, who died at his home, Mount Randal, Cranmore Park, Belfast, on Friday, 12th May, 1922, in his 82nd year, was a foundation member and one of the first vice-presidents of the Textile Institute. He occupied the latter office from the year 1910 to 1919. At the second Autumnal Congress of the Institute, which was held in Belfast, 1911, he was not only chairman of the arrangements and reception committees, but was the moving spirit in all the matters of detail which made the Congress a memorable occasion to all who participated in it. The large numbers of delegates who attended, both from Great Britain and Ireland, the excellence of the papers and discussions, the good results of the Congress in general, the magnificence of the civic reception, and the interesting series of visits arranged, were largely the results of his untiring efforts and devotion. It is worthy of note that the deceased gentleman continued to manifest a deep interest in all the work and development of the Textile Institute until about three and a half years ago, when he was permanently incapacitated by illness. He was ever ready to aid by his advice and influence every general and local proposal to further the interest and prosperity of the Institute. The late Sir Wm. Crawford was a leader in the Linen Industry of Belfast and the North of Ireland for more than a quarter of a century; for over 30 years he was a Director of the York Street Flax Spinning Mills, and for many years the Chairman of the Directors of this vast concern.—F. B.

BRITISH WOOL RESEARCH ASSOCIATION FELLOWSHIPS, ETC.

Conditions governing Research Fellowships and Advanced Scholarships to be awarded next session by the British Research Association for the Woollen and Worsted Industries (Torridon, Headingley, Leeds), have been issued, and an announcement on the matter appears in the advertisement pages of this Journal. Each fellowship is to be of the annual maximum value of £200, to be granted for one year only but may be renewed for a second year subject to various considerations. Applications for a fellowship must be made before 30th June, and must give full particulars of training, degrees (if any) and practical experience, whilst candidates are required to submit an outline of the subject of research, the equipment necessary, and the place in which it is proposed to carry on the work. It is pointed out in the conditions that while it is contemplated that the fellowship may be held at an educational institution it is not intended to exclude individuals who may have other resources at their disposal, *e.g.*, in factories.

With regard to the Advanced Scholarships, the conditions provide for that each advanced scholarship shall be of such a value as will cover fees, travelling expenses, and books, together with a sum which, with any private resources, will be adequate, but not more than adequate, to maintain the scholar in view of his or her particular circumstances. Each scholarship will be granted for one year only, but may be renewed at the discretion of the Association. The scholarships are to be tenable either in this country or abroad at the discretion of the Education Committee of the Association.

CITY AND GUILDS OF LONDON INSTITUTE.

The above-named Institute has for many years held examinations in cotton subjects throughout the United Kingdom and at several centres in India. In connection with a complete course of science subjects allied to cotton manufacture, the Institute named has accepted a proposal that it should hold an examination of Final Grade in the subject of " Chemistry as applied to the Cotton Industry." In this connection, the Examinations Board, on the recommendation of the Textile Institute, has invited Mr. S. H. Higgins, M.Sc., of Manchester, to accept appointment as examiner.

DESIGNS FOR TEXTILE PRINTING.

The governors of the Royal Manchester Institution have issued an announcement offering a " Travelling Scholarship " of the value of £35 for the best set of designs for textile printing. The competition is confined to persons resident within twenty miles of the centre of Manchester, and the designs are to consist of (*a*) 10 designs for shirtings, (*b*) 5 for 3-colour fancies (dress fabrics), and (*c*) 3 designs for cretonnes. Candidates are required to visit London, or other centre approved by the governors, spend not less than three weeks there in studying textile fabrics, and present a written account of the visit and study. Inquiries should be addressed to 38, Barton Arcade, Manchester.

CHEMICAL SPECTROMETER.

We have received from Adam Hilger, Ltd., a leaflet giving a description of a new type of chemical spectrometer. This combines the advantages of their well-known wave length spectrometer with the compactness and portability of a microscope. The principle is simple :– The light is auto-collimated, falls on a 30° prism and then returns along its path to an eye-piece. To traverse the spectrum, the prism is tilted by means of a screw with drum head on which is engraved a scale of wave lengths.

SCIENTIFIC PERIODICALS.

The Conjoint Board of Scientific Societies has had under consideration for some time past the question of the publication of a world list of scientific periodicals. It is recognised that the production of a work of the kind contemplated would in all probability not be entertained by a publishing firm as an ordinary commercial enterprise, and the trustees of the British Museum, appreciating the importance of the work to scientific research and bibliography, have consented to allow the work of compilation to be undertaken by the staff of the Museum. Institutions and libraries throughout the country have been invited to agree in advance to purchase one or more copies at two guineas each when issued, and, already, it is stated, a substantial amount of the material for publication has been collected in the British Museum by various organisations and societies, and by the Conjoint Board.

THE COLOUR USERS' ASSOCIATION.

This Association has recently issued to its members a small booklet which provides a complete reference as to membership and the various groups into which the membership is divided. The objects of the organisation, comprising only five clauses, provide for the continuance and extension by the Association of the work hitherto performed by the Colour Users' Committee. It is intended that the association shall act as an official body for the representation of all concerned in the use of dyes in all negotiations with the Government, or with Government Departments and in negotiating generally. The association covers a wide field as is shown by the list of trade groups—Calico Printing, Wool, Cotton, Silk, Garment, and Hosiery Dyeing, Wallpaper and Lithographic Printing, Paints and Pigments, Straw Plait and Felt Dyeing, Paper Makers, Woollen Piece Dyeing, and Miscellaneous. The booklet contains, in addition to the usual list of officers, members of council and committees, a considerable amount of general information and data of a useful description, including a recital of the provisions of the Dyestuffs (Import Regulation) Act, 1920, and information as to procedure under the Act. The offices of the Association are at Cromwell Buildings, Blackfriars Street, Manchester, and the Secretary is Mr. Ellis Green, F.C.A.

RAILWAYS AND ROAD HAULAGE.

The fight for road haulage powers by the railways is now in full swing, and is going at a rare pace. The particular stage at which the bill has arrived, the committee stage, is the best for fighting out the issue; the respective sides are able to concentrate all their weight of metal on the issue without distraction from other Parliamentary matters, and, pretty obviously both sides have recognised the importance of the issue. The whole question is a matter of great concern to the textile areas. As has been pointed out by witnesses called by the railway companies, the processes of manufacture call for transport facilities that to-day the railways alone cannot give, and it does not follow that the road haulage interests in themselves give adequate facilities. It is well that the voice of industry should be heard in this matter, for it has to be remembered that transport exists because of the service it renders to commerce. Of itself, it is not a creative industry; it affords facilities for expansion, but alone it cannot create trade. If it were otherwise, there would have been no slump, for there are road vehicles enough, to say nothing of the normal facilities offered by the railways, to keep the whole of the trade of the country busy. First and foremost, the whole question of transport ought to be regarded in the light of the service it can render, and if the railways demonstrate that this service can be improved by the grant to them of road running powers, then those powers ought not to be withheld. It can at least be said that transport cannot be successfully run, that is in the light of the service it can render, if operated in watertight compartments. And, as the railways can do something to co-ordinate road and rail services, it would appear that they have a good claim to these powers. The fear of the road haulage interests that they might be squeezed out does not seem to be widely shared. They will have their fair chance, if only they operate on up-to-date lines, for the individualistic character of the road vehicle is a vital factor. —R. G.

THE U.T.R. MAGAZINE.

The "house" magazine of the United Turkey Red Co., Ltd., Glasgow, is an excellent example of this growingly popular form of publication, judging by a copy of the Spring Number which has reached us. It is well illustrated and carefully compiled, and runs to 32 pages on art-surface paper. An interesting example of turning illustration to good account is provided by the reproduction of a photograph of the Company's exhibit of yarns at an exhibition in Glasgow. Accompanying the illustration is an article giving information as to the destination of these goods, ultimate uses, and the trade channels through which the manufactures pass.

UNEMPLOYMENT INSURANCE FOR INDUSTRIES.

Commenting on the wastefulness of our system of administering the dole in respect of unemployment, Sir Charles Macara writes expressing satisfaction that, in addition to the Ministry of Labour taking an interest in the matter, there is a prospect of a Bill being introduced before long to make various industries responsible for their own unemployment and give them power to manage their own schemes. "The miners, like the cotton workers," says Sir Charles, "would have less to pay and more to draw under a system which wiped out State doles and substituted schemes managed by representatives of the workers' and employers' organisations. Besides ensuring economy in many ways, we should prevent malingering, for if one section of a trade had to sustain a levy for another ample safeguards against abuse would be enforced. Cotton workers and miners, therefore, have a unique opportunity of initiating a great scheme, and one which would serve the interests of the workers and the country generally far better than the iniquitous system of dealing with unemployment we have in operation at present."

GENERAL ITEMS AND REPORTS

EXCHANGE STABILISATION.

An interesting paper on "Certain Aspects of the Problem of Exchange Stabilisation" was recently read by Mr. O. T. Falk, O.B.E., before the Royal Society of Arts (see *Jl. Roy. Soc. Arts*, 1922, 70, No. 3,622). Mr. Falk prefaced his contribution to this difficult subject by criticising our post-war financial policy. The partial failure of this policy he attributes in the main to the influence exerted by the reports of the Cunliffe Committee, which aimed simply at a restoration of pre-war conditions, and failed to appreciate the wider economic interests involved. However, the most conspicuous failure to deal with the situation has, in Mr. Falk's opinion, been due to the reluctance of the Treasury and the Bank of England to adjust the bank rate in accordance with the great trade fluctuations during recent years. The worst features of both the boom and the depression could have been mitigated and a more stable standard of value could have been maintained if the bank rate had been raised earlier during the boom and lowered sooner during the slump. He held that the present serious position justifies a 2 per cent. bank rate.

Before the problem of the stabilisation of the exchange can be tackled, there must be (a) a practicable settlement of the Reparation and inter-Allied debt problems; (b) a reduction in the size of the unfavourable balance of our trade with the United States, and the maintenance of this reduction for a considerable period; (c) a restoration of complete confidence in the ability and determination of our Government to balance the budget. Even when these conditions are fulfilled, the difficulties to be faced are considerable. These difficulties Mr Falk dealt with under four headings. Under the first, he considered the question as to the settling of the daily accounts between this country and other countries. Before the war, when fluctuations in exchange lay between the gold points, the differences were settled by international bankers, who bore the risk. With the abolition of the gold standard the risk was increased tremendously and an opportunity created for speculation. Since the Armistice, the banks have carried on their function of settling differences, but other people have borne the risk. There has been, and still is, a large number of people engaged in speculating on the movements of the foreign exchanges, and it is due to their activities that credits have been granted and the exchanges maintained. Before stabilisation can take place, it is essential that the daily differences should be within the capacity of the bankers, for with the restoration of the gold standard speculation will cease. Mr. Falk pointed out that these differences will probably be bigger than before the war, owing to trade fluctuations in the uncertain economic and political conditions which are likely to obtain in the near future, while the assistance given by the movement of securities will be less, with borrowers' credit weakened and the existence of double taxation.

A second difficulty lies in the large number of Treasury bills in the hands of the public and joint stock companies, which lessen the power of the Bank of England to control the exchange and replenish our money market. He did not consider the funding of Treasury bills a feasible proposition, nor variations in the discount rate likely to be effective; some new solution would have to be found.

Before the war, when our gold reserves needed protection at short notice, it was customary to call in foreign loans. It is possible that there has been a fundamental change in the amount and the type of indebtedness of foreigners to this country; if the loans are smaller, or of longer date, both of which seem extremely likely, the policy hitherto adopted will have to be re-adjusted.

In view of the fact that it is clear that the world's gold supply is not large enough to meet present requirements without strict economy, Mr. Falk deprecated the suggestion of the Chancellor of the Exchequer that there is a possibility of a resumption of a gold currency in circulation in this country. He appealed for a fresh Committee on Currency. —F. C.

THE PROPER FUNCTIONS OF TRADE UNIONS.

In the course of a paper read before the Royal Society of Arts (see *Jl. Roy. Soc. Arts*, 1922, **70**, No. 3261) on this subject, Mr. W. A. Appleton, C.B.E., defined a trade union as "an organisation for the betterment of wages, hours and working conditions of persons engaged on similar materials, using similar tools, and producing similar results." The functions of trade unions he regarded as limited to the promotion of the economic welfare of their members. Only in matters vitally affecting their economic interests was political action as trade unionists justifiable, and then pressure must be exerted through the existing political parties. "Direct action" was to be condemned rigorously. It was essential that trade unionists should have clear ideas about value, and a knowledge of the factors which determine wages before they attempt to negotiate wage questions. The most important factors governing money wages were briefly enumerated under the heads of (1) The capacity of the workers; (2) the organizing capacity of employers; (3) the accessibility and cost of raw materials; (4) the accessibility of markets; (5) the nature of demand; (6) the terms of the contract between employers and workers; (7) the facilities which exist for the utilisation of fixed capital; (8) the incidence of taxation; (9) legislation which restricts the use of fixed capital. The policy of granting subsidies to certain industries had set up economic reactions which had lowered the real wages of the workers. In dealing with the question of working hours trade unionists must recognise the great variations in the strain involved by different occupations. While it seems possible to fix hours for indoor occupations, the fact that outdoor occupations depend largely on conditions over which man has no control, makes the question of a legal working day one of immense difficulty. The task of securing good working conditions is shared by the unions and the State—the former are concerned with settling details of workshop organisation in the interests of their members, and the latter with questions of sanitation, safety, &c. Dealing with the important problem of unemployment the lecturer outlined the policy of the early trade unions who, out of their desire to protect their members, and to attract new members, added unemployment benefit to their other functions. When the work of organising the unskilled labourers was undertaken in the 80's it was realised that in order to get this class into unions the contributions would have to be considerably lower than those paid by skilled workers. The unemployment benefit being, after strike pay, the most expensive benefit, was not attempted by the new unions. However, when the State provided funds for the support of the unemployed these unions asserted their right to administer the benefit. The principal reasons why the unions failed to take proper advantage of the opportunities provided by the 1920 Act were : (1) The competition between the unions; and (2) the fact that many of the unions made false calculations. For this Departmental actuaries were largely to blame, for they estimated that the average weeks of unemployment would be two-and-a-half, and on this basis these unions offered £1 a week for a 6d. contribution. Before the schemes had been in operation long the unions found themselves insolvent, and had to suspend further payments. Some unions, however, followed a more cautious policy and have been able to weather the storm up to the present time. The lecturer affirmed his belief in the policy put forward by the General Federation of Trade Unions, "that each industry shall provide and administer its own unemployment fund; that the industry, rather than the union, shall be the unit, and that contributions shall consist of a percentage on wages." For convenience the employer might be made the actual payer. Workers who could not be grouped in specific industries could form a common society. The residium, including the unemployable, could be dealt with by the Boards of Guardians. —F. C.

REVIEWS

Brazilian Cotton. By Arno S. Pearse. (International Federation of Master Cotton Spinners' and Manufacturers' Associations, Manchester; pp.231, with 10 maps and 64 illustrations. Price 21/-.)

A report of the journey of the International Cotton Mission through the Cotton States of Sao Paulo, Minas Geraes, Bahia, Alagôas, Sergipe, Pernambuco, Parahyba and Rio Grande do Norte, from March to September, 1921. The immense size of Brazil, almost as large as the United States of America, with vast tracts of country naturally suited to the cultivation of cotton and a well-established cotton industry, provided sufficient justification for the Mission.

The volume opens with a description of the mission, its objects and methods, and with a chapter on the geography and history of Brazil. The early history of the cotton spinning and weaving industry is dealt with, and, after general remarks on Brazilian cotton and on the great possibilities latent in Brazil as a prominent source of supply of cotton to the world, the different States are treated in detail separately. The industry is described in each case, the difficulties are emphasised, and the factors involved in future extensions are pointed out wherever possible. All the samples brought back by Mr. Pearse were handed over to the Fine Cotton Spinners' and Doublers' Association for examination, and Dr. Balls' report on several of these samples is incorporated in the work. Concluding chapters deal with the cotton export houses of Pernambuco, Parahyba and Rio Grande do Norte, with various exports of Brazil other than cotton. An appendix furnishes particulars of Brazilian cotton mills, and gives an address delivered at the conclusion of the mission at Rio de Janeiro.

The book, as we have indicated, is an attractive volume, the subject matter is presented in an interesting manner, and the illustrations and printing are throughout excellent. —W. R.

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PROCEEDINGS

YORKSHIRE SECTION.

Meeting at Bradford, 9th March, 1922, Mr. John F. White in the Chair.

ECONOMICS IN ORGANISATION OF TEXTILE FACTORY LAYOUTS.

By P. T. Runton.

At the commencement of his paper, Mr. Runton gave it as his considered opinion after thirty years' experience that "we have too many people doing jobs in mills without the co-related knowledge of the preceding or sequential matters involved." There was the machine-maker, the boilermaker, the engine builder, the heating fitter, lighting erector, building contractor, probably an architect or engineer, and the man with every kind of device each of which was saving so much per cent. until one might expect to be able to run a plant for nothing. Each was concerned in his own allotment, and each a swimmer. Who was directing and supervising them all? The employer—the very man who should have his sole attention directed upon that in which he deals, the markets, production and profits, not being technically trained and unable to devote a fraction of the time really necessary in quiet thought, research, or technical organisation. The best technical advice always paid, no matter what the cost.

No new scheme or re-organisation should be embarked upon before a complete review of all proposed or existing plant was made and balanced and a finished scheme of layout made in proper sequential working order, eliminating all non-essentials. That involved every machine and service being worked out before any attempt was made to clothe such proposals with new buildings, alterations, or additions. And who was to undertake it—the employer or proprietor, the machine-maker, the contractor, the architect, or engineer? The machine-maker was out to sell his machinery; the professional man wanted a building erecting, and so on. But what does the employer want? He should want the most economical and up-to-date scheme available. Does he always get it?

Mr. Runton expressed the opinion that much of the inefficiency existing was due to the fact that employers generally had not encouraged the existence of the type of highly-trained technical men necessary to industry. It was a costly training which, in the ordinary way, few men had either the means or the courage to undertake. So they saw many possible "winners" fail because the layout had not been worked out by one capable of exercising the technical imaginative faculty enabling all the various units and dependent parts to be brought together as a homogeneous whole. That was the treatment which industry, if it had a voice, would cry out for.

Indulging in a little friendly criticism of suppliers, Mr. Runton asked if they were in a position to form a correct judgment without complete knowledge of the co-relation of the adjunctive services and workings? Did such procedure tend to economical results? He feared it was often unwise, for, while their machines did their work, the supplier was not always able to advise as to the best methods or the most economical. Advisers should not be afraid of condemning a scheme or idea when advising an employer on his requirements.

Proceeding to deal with the economics of factory layouts, Mr. Runton urged the importance of the primary work being thorough. Before one could form any opinion based on sound economics, it was necessary first to understand the particular trade processes, then to have particulars of the plant and see that it was balanced with the basic unit, and, lastly, to make a diagramatic plan of the plant, tracing the raw materials on all its journeyings until it became the finished product ready for the rails. Then, and then only, could they set about clothing their scheme in an effective manner. How often one found with many people that first cost was the only consideration. They overlooked the fact that it was not the first cost which counted ultimately, but the cost to maintain in relation to production. Therefore, quality and being up-to-date had to be considered simultaneously with first cost. Next in importance was the necessity of providing every modern available appliance which would save labour, give economy with efficiency, and increased production.

The power plant might be described as the soul of the factory, and the boiler-houses as the stomach. Yet how often one found them placed with total disregard for the work they had to perform. The power plant and central transmission or head shafts should be placed as centrally to the load as possible having regard to access and working space for removals, &c., replacements, and sufficient room for modern transport to move about in.

After reference to the relationship of flues, economisers, and chimneys, Mr. RUNTON spoke on the advisability of secondary services for use when the engine power was not available, especially motors for boilerhouse plant, stokers, economisers, pumps, and coal elevators.

Having dealt with the re-organising of existing works, Mr. RUNTON proceeded to describe a new scheme. He spoke of the importance of site selection and the layout of internal roads, proper room for passing if haulage and similar losses were to be eliminated, roads intercepting or sectionising various departments, so preventing serious loss in case of fire; fire service, drainage, effluent-water services, and the like. Nothing should be left to be settled afterwards.

A block plan was shown of a new scheme two-thirds worsted and one-third woollen, with all departments from start to finish, and entirely self-contained. Plans, he said, were merely the means to the end, however; it was the technical imaginative faculty which counted. The designing board, or more correctly speaking the thinking department, told in the factory. To meet the crying need of the industry, why should not employers co-operate and form their own expert technical departments in groups of reasonable and manageable size with central stores, laboratories, &c.? He knew of one particular trade where that was being done by small private limited liability companies, limited to the number of members in each case, supplying their own needs with much saving and greater efficiency, because one super-skilled man was thinking out the same thing as a dozen others would have been, and that left employers free to devote their energies to production, markets, and so on.

DISCUSSION.

Mr. G. W. CHADWICK (Leeds) said he noticed, in one of the plans shown, a line across a building which was presumably a drain. The idea, apparently, was to shorten the line, but was it desirable to run a drain in that way under a floor on which there would be machinery? Would it not be costly to repair the drain if there were a breakage? He noticed, also, the drains running down the centre of the roads. What would be the depth of those drains? At his own place they had run the drains under the causeway, where there was no heavy traffic. What did Mr. Runton think of that idea? In another plan, he noticed the office placed at the corner of the site. Was this preferable to the centre? He could understand that there might be a point about not desiring travellers to see too much of the works, but would it not be more central from the point of view of consultations with foremen, and so on, to have a central position for the office?

Mr. ICKRINGILL referred to the distance between the boiler-house and the power-house as indicated on a plan shown. Were they to assume that electric power was used, or had the steam to be carried from the boiler-house to the power-house?

Mr. W. BINNS asked Mr. Runton what he thought about turbo-electric direct drive in mills, and also the turbo direct drive without electric transmission.

Mr. H. KITCHIN said he noticed that the flue of the chimney from the boilers, after passing through the economisers, was at right angles. Was it an advantage to have a right-angle flue? With regard to heating, there were in mills many miles of piping for the radiation of heat. Mr. Runton had mentioned a case in which economy had been effected by reducing the pressure from 110 to 40. What economy was actually achieved? Did the same amount of steam from the boilers heat more room or was it a question of saving fuel?

Mr. ICKRINGILL referred to the point made by Mr. Runton with regard to easier access for flue cleaning and the inspection of the boiler itself. Would Mr. Runton give them an idea as to how one of the latest schemes worked?

Mr. J. H. BINNS asked if it was not a fact that some of the latest devices for flue cleaning created a nuisance to surrounding property by discharging dust and grit.

Mr. BEANLAND (Clayton West) said he would like more information as to the relative capacity of the buildings. He was more interested in the block type of mill used for spinning. Did Mr. Runton recommend that drawing, roving, spinning, twisting, and winding should be kept separate, or each room be self-contained from drawing right through?

Mr. RUNTON, in reply, dealt first with the questions raised by Mr. Chadwick. He said the line across the building referred to did not indicate a drain. The whole of the water for the tanks, the dyehouse, the finishing processes, and the sprinkler, was taken from a reservoir in the corner of the site. The line indicated a concrete aqueduct from the reservoir or dam. The depth at which drains should be laid depended upon the falls and levels to be contended with. Any drain lower than five feet would be safe from damage by the load on the surface. With regard to the office being placed at the corner, the whole of the traffic worked down to it in that position. All visitors, whether buyers or travellers, had easy access to the office, which was adjacent to the pattern rooms and warehouses. It was only necessary to communicate with the heads of the departments to make enquiries, and with a system of telephonic intercommunication it would in many cases not be necessary to summon the head of the department to the office. A telephone message would suffice. There was a question with regard to the distance from the boilers to the power-house. It was merely process work. There was a 2,000 kwt. electric plant. He could not reply to the question about turbo-electric drive. That was a matter of detail. He was dealing with main principles. With regard to the chimney flue being at right angles, they would notice from the detailed plan that the flue was fed into the chimney from the economisers and the centre of the flue was the direct centre of the economiser. The reason for the flue being some distance away from the chimney was that sufficient room was left for two more boilers to go in there, or they could put a turbo-generator sub-station there in case the power companies altered their conditions.

Mr. KITCHIN said the draught would have to go round a corner.

Mr. RUNTON said that would make no difference. Continuing to deal with the question with regard to heating, he said if they reduced the pressure from 100 to 40 there was an increase in capacity of 120 per cent.

Mr. BINNS asked for further information with regard to the flue cleaning.

Mr. RUNTON said that on the top of the boilers there were control valves, three or four together. They simply turned each one on and then shut it off, in turn, and the dust was blown through into the by-pass chambers. On the top, there were sprinkler pipes connecting with the hoppers, and the dust passed through into the water and settled down there. All they had to do was to open a steel trap and away it went. He was not prepared to answer Mr. Beanland's question because that involved details, and, as he had already said, he was dealing only with main principles.

The CHAIRMAN said that Mr. Runton had rendered great service to the industry by the manner in which he had dealt with the whole question. He had been particularly interested in what had been said about the heating of factories. He had had experience in another country where the use of hot air and fresh air had been used very effectively. In the hot season, great benefit had been derived from the introduction of fresh air into the factory.

Mr. CHADWICK, in moving a vote of thanks to Mr. Runton, said he had made them feel that it would be a good thing if they could have their factories bombed so that they could make a fresh start. A good deal of their trouble to-day was that they had not sufficient capital to enable them to deal with their defects in construction and layout as they would like. In Yorkshire, they often envied those in Lancashire who could lay out factories knowing exactly how much to a foot per spindle was required in laying out land and machinery. His firm was engaged in woollen and worsted manufacturing, and the trouble was that the utility of part of their machinery might shrink, whilst there would be considerable development in another part. He thought they ought to pay more attention to comfort and general surroundings in planning offices and factories, and, in view of the amount of time they spent in them, it was surprising that they did not give more consideration to these things. Perhaps in ten years' time when things worked round they would be able to spend more money in developments on the lines indicated by Mr. Runton. They were certainly now getting more co-ordination between the manufacturer and the machine-maker, and that was all to the good.

Mr. J. H. Binns, in seconding, said he had been particularly interested in the lecture because his firm were engaged in the layout of a new factory and he found that they had adopted many of the ideas, particularly in the reduction of the number of routes, which Mr. Runton had advocated. They were often bewildered by the varying advice which was given to them by architects, machine-makers, and engine builders, and it would be an advantage if they could go to someone who could give them really expert advice right through.

The Chairman said the Yorkshire Section of the Textile Institute was particularly indebted to Mr. Runton for the great care which he had taken in preparing his lecture, and particularly in getting out so many plans.

Mr. Runton, in reply, said there had not been much encouragement in the past for the industrial engineer. It required a good deal of courage for a young man to embark upon such a profession in view of the long time which would elapse during the necessary training, particularly in view of the reluctance of employers to entrust the investment of their capital in new factories to young men, but he could assure them that there were industrial engineers capable of doing the work satisfactorily.

LANCASHIRE SECTION.

Meeting at Manchester, 14th March, 1922, Mr. W. Greenwood, M.P., in the Chair.

THE HUMAN ELEMENT IN INDUSTRY.

By W. Harrison, M.Sc.

In most cases a discussion on the Human Factor in Industry resolves itself into a discussion on the efficiency of the numerous operatives employed in industry. I do not propose to limit my paper to this section because it must be clear to outsiders that the operatives do not represent the only human factor entering into the conduct of a business. I have had many opportunities during the last 15 years of learning a good deal about the several sides of business without getting so involved in any particular side as to forget others. It is on this account only that I venture to commence a discussion. I shall speak as an observer of many sections and not as an active worker in any.

Everyone will agree that the influence of any one individual on a body of men with whom he may get into contact is greater the higher the position held by that individual; hence, his capacity for distributing good or bad is greater. A mistake on the part of an owner or a manager is likely to cause much more trouble than one on the part of an operative. We see, therefore, that owners and managers are, if anything, the most important human factor in industry, and until they have put themselves in order the other human factors cannot be properly balanced.

One point I wish to make is that men who are intended for managerial positions should receive a training properly adapted to requirements, and one of the most important subjects is that of human nature. We must realise that a man intended for a managerial position as a rule takes less personal interest in his own education than one who has to make his own way in the world. Any teacher in school, college, or university will confirm this. The result is that such men take up their duties with a severe handicap. Knowing the unfortunate results of this, many owners believe in putting their sons into the business at an early age. This gives them business knowledge, but it is probably the same knowledge which may have been in that business for many years, and what a young man really wants is knowledge which will help him to run the business under newer conditions. Parents should themselves take more personal interest in the training of their sons, and pay periodical visits to the institution at which they are being trained.

Recent developments have enlarged our knowledge of the factors governing human behaviour. These factors operate in all cases, human nature being essentially the same all the world over. Self-preservation not only refers to life, but to status and position in life. Nutrition applies not only to food consumption, but to food utilisation, and is, therefore, governed by health, and by fatigue, worry, and other factors which modify health. Herd instinct has a much greater influence in life than is generally supposed. Personally, I do not think that human behaviour can be fully explained on the basis of these instincts. There are at least two other factors—the first, chemical effects within the body due to the action of external as well as internal influences, and the other, what we may call the intellectual instinct which arises as a direct consequence of the development of intellect.

To-day, business is a very complicated matter, and industrial systems have developed in most unlooked-for directions. There must be something radically wrong with an industrial system which leaves half the operatives unemployed and the other half suffering from fatigue or discontent. To remedy this requires a man with training which adapts him for diagnosing the cause of industrial unrest and curing it with the same degree of certainty as a qualified doctor diagnoses and cures diseases of the human body. Unfortunately, industry has been like the sick man who would not admit himself sick until he was unable to carry on. The result is that no doctors have been called in, neither has there seemed sufficient demand to encourage men to qualify themselves for the work. The result is that industrial troubles have gone uncured and therefore become worse. Even to-day, with big troubles before us and these growing larger every year, practically no men are going in for the study of those subjects which would assist in the cure. We try to settle the troubles with household remedies and feel surprised when they break out again in more virulent form.

In industrial life, self-preservation mainly refers to the preservation of one's status or position in life, and, when this can only be attended to at the expense of someone else, then some kind of warfare is bound to result, and like all other kinds of warfare the battle goes to the strong whether it be physically or mentally.

The various employers' associations and trades union organisations illustrate the development of self-preservation in the direction of mass action primarily connected with the herd instinct. Warfare between masses is a much more serious problem than warfare between individuals and should be avoided wherever possible. Whoever wins in a trade dispute, the inevitable result is a loss of efficiency. A friendly spirit between employers and employed will do more towards increasing efficiency than any industrial dispute. If operatives are forced into what they consider an unfair bargain, sooner or later they will try to balance it. A lockout when trade is bad is met by a strike when trade is good, and both sides lose. It is human nature, and one cannot get away from it. The men are convinced that the employers wish to destroy their biggest weapon of self-defence, and that is a great stimulus to the instinct of self-preservation. An attitude of diplomacy and not challenge seems to be required.

Insecurity of employment is also a powerful stimulus to the instinct of self-preservation. When orders are scarce, large output means less time of employment. Hence, as a rule, workers reduce their output as much as they can or dare. Unfortunately, they do not increase their output in the same relation when trade is very good, because they either lack incentive or knowledge of the conditions. They are told when trade is bad, but not always when trade is good. The removal of this insecurity of employment would do much towards increasing output provided that rigid conditions were laid down. There is, of course, a chance that operatives might take life easy if employment were absolutely secure; hence, one must lay down some rigid conditions for permanency. There is no doubt that individual industries could provide security of employment or insure their own workers against unemployment at less cost than by the present system of doles, for which industry has to pay through the nose in the form of taxation. Moreover, it could be done in such a manner as not to encourage laziness. It may be thought that as taxation applies to the whole of the community, industries only pay a proportion of the cost of doles, but, as the money paid by the community lessens the amounts available for the purchase of manufactured commodities, the result is a direct loss to industry as being the only source of wealth in an industrial community. Any more efficient system—and few can or will say that government systems are efficient—will eventually be a benefit to industry.

The number of cases of inefficiency caused as the direct result of faulty nutrition is far greater than is usually imagined. In the operative it causes inability to work hard, and in a foreman it may result in bad temper or general incapacity to supervise. Malnutrition may be caused by other things than wrong food, such as eating in a crouching posture, or perhaps sitting in a corner of the works. Another cause is the attempt to tackle hard physical or mental work immediately after a meal, when blood circulation is required by the digestive organs. This applies most particularly to sedentary workers and those operatives not physically fit.

The herd instinct plays a much bigger part in industry than appears at first sight. According to Trotter, on account of this instinct, men are intolerant and fearful of solitude either physical or mental. This intolerance is the cause of the mental fixity and intellectual incuriousness which he constantly displays to an extent very remarkable for an animal with so large a brain. The resistance to a new idea is primarily a matter of prejudice, the development of intellectual objections, just or otherwise, being a secondary process, in spite of the common delusion to the contrary. It is not only the workpeople who object to the introduction of a new machine in a works. Many owners and managers are quite as difficult to convince on the value of a new machine, and they are always ready to produce the excuse that the workers would not take to the new idea. Once a machine maker has sold a few machines, he proceeds to inform a probable customer that so-and-so and so-and-so have bought it. The herd instinct comes into play and the machine is bought not because it is an efficient machine, but because so-and-so has one. Trotter also says that man on the average is more sensitive to the voice of the herd than to any other influence. It is the source of his moral codes. It can endow him with energy, courage, and endurance, and can as easily take these away. During the war, we saw men moved to energy, courage and endurance by this very instinct, and, after the war, we saw the same men moved to slackness, doubt, and discontent. One must remember that the herd follows a leader, but it must be one of the herd. A leader from another herd of an entirely different class is seldom followed. Hence, to influence the crowd one must associate oneself with it, become one of it, at least for the time being. I am fully convinced that the workers of this country can be influenced in the right direction just as easily as they are now influenced in the wrong solely by virtue of the herd instinct. One must not forget, however, that this instinct moves men of all classes. Employers have been led into wrong actions against the workpeople, often against their better judgment, but having voted in favour of the action when influenced by the voice of the herd they feel they have no choice but to keep their word—in fact, keeping one's word is also an action caused by the herd instinct. One cannot get away from the effect of this instinct unless one is prepared to face the consequences. To act in a manner entirely contrary to the herd results in one being ignored and to have to face that solitude which the herd instinct makes intolerable to man. Thus does the human being, moved by the herd instinct, react towards his fellow men should they be tainted with originality or react to knowledge instead of to instinct. Yet, the world would not make much progress without those persons cursed with originality. The herd instinct wants a curb put upon it, and that can only be done by conscious effort after fully recognising its actions. Intellect is the only counter to instincts.

The need for broad education was never greater than it is to-day, and by broad education I do not mean that memory training and memory examination system of to-day which we are led by the herd instinct to believe is true education. I mean training of the logical faculties, which, unfortunately, is neglected for the sake of red tapism. When we say that the education which was good enough for us is good enough for our sons and grandsons, we are acting in response to herd instinct and not to reason. Reason tells us that the world is changing continuously, and that education must necessarily change with the times.

Having dealt so far with the effect of primary instincts on industry, I will proceed to refer to a few special factors, *i.e.*, movement study, fatigue study, and selection study.

In the textile industry, the question of elbow room is very important. Very often, the first attempts to alter a method of handling results in failure; this happens because the old methods have really been worked out by experiments carried out, perhaps unsystematically, by the operatives over a long period. If one wishes to make use of movement study as a means of increasing efficiency one must create interest in the newer methods. Very often this is only a question of tact. Leave a workman sufficient reason or opportunity for convincing himself that he has developed the new method himself and at once he becomes keenly interested. If he should have been instrumental in influencing the development, see that he gets full credit for it, for the more generous one is in this respect the more one will gain in the long run.

As regards methods of stimulating interest in new methods, perhaps the best is that of arranging a bonus for increased efficiency. There are several systems in use which would take some considerable time to discuss. The best plan appears to be that of Emerson, according to which a minimum wage is paid and a bonus which increases in percentage as the output increases. As every successive increase in output of any article requires greater and greater effort, this system provides wages proportional to the effort made. No system which increases output at the expense of permanency of employment can exist for long. The operatives think that if merchants are permitted to hold up stocks to keep the prices up, then they themselves have a right to hold up labour for high wages or permanency of employment. Labour is the commodity which the operative has for sale.

The question of fatigue is one which had a great deal of attention during the war when a few operatives had to do the work of many. It was found that in most cases increased production resulted from shortening the working hours, by instituting rest pauses, and by careful attention to ventilation and humidity. Nowadays, with the considerable reduction in trade, there is no need for the operatives to overwork themselves, and, except in the certain cases of heavy manual labour, it cannot be said that fatigue is so very common. Managers would in fact be glad to have a few cases of real physical fatigue to deal with. The most prevalent form of fatigue is nerve fatigue, and this is less common among operatives than among those in control. This form of fatigue results from causes not usually associated directly with the work done. Anything which detracts to a considerable extent from one's attention to work tends to produce nerve fatigue. It may be the noise of machinery, and anything of a periodic nature is very upsetting.

Of the large number of persons engaged in industry, few are in the position for which they are most fitted. Many persons accept the advice of friends or relatives and choose the wrong occupation; others follow the occupation of their father or grandfather, very often under compulsion of one kind or another. Others are actuated by expected influence or attracted by interest and imagination to occupations for which they have no real aptitude. Thus, efficiency is minimised. Little blame can be attached to any of the employees. In the early days of the war there was a big demand for chemists and a great deal was said about the future of chemistry. This year, there are nearly 2,000 young men studying chemistry, whilst last year and the year before the number was greater. Thus, at least 5,000 men have been trained as chemists since the war and there are not openings for one-tenth the number because the value of a chemist in industry is not understood. I think we ought to advise the colleges and universities concerning the kind of man we are likely to want in the next few years so that such a surplus of specialised service cannot arise. Personally, I think specialisation in the colleges and universities should be avoided. A man has to make the best of the opportunities which arise and not wait for an opening specially suited to his training. Adaptability, backed by general knowledge, is the best foundation for a business career. If a boy has special abilities these ought to be cultivated fully, but other possibilities should not be neglected. The completion of a business training should take place in the factory where the variety of occupation leaves open the opportunities for adaptation to particular jobs.

The human factor in industry is a very much bigger thing than is usually imagined. The condition of industry to-day, or at any time, is not due to any single human factor but to the actions and interactions of the various human factors on one another. The actions of every section are governed by circumstances modified as they are by the various instincts to which man must react. The action of any one section necessarily produces a reaction in the other sections which tends to balance the effect of the first. The idea that business is ruled solely and entirely by economic law is a fallacy which ought to be got rid of as soon as possible. Based on the arguments of economic law, we construct business in such a way that commodities are manufactured quicker than purchasing power is distributed. Douglas concludes from this that manufactured articles should be sold at less than the cost of manufacture so that purchasing power in the form of wages should be distributed as quickly as commodities. Operatives, on the other hand, conclude that output must be restricted so that commodities are made as slow as purchasing power is distributed. As both of these are logical conclusions based on economic law and as neither remedy appears sound to business men, it follows that economic law is either unsound or not the main factor in business. The human factor is and will always remain the main factor in business.

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NOTES AND NOTICES

NEW MEMBERS OF THE INSTITUTE

At a meeting of the Council of the Institute held at Manchester, on Wednesday, 21st June, 1922, the following applicants were elected to membership :—Bertram Davenport (Manchester), J. Hartley (Colne), Andrew Hodge (Stockport and Manchester), O. Jones (Sidcup, Kent), George Bilsborrow (representing Moorbrook Mill Co., Ltd., Preston), M. B. Mande (Amarapura, India), J. L. Pullar (Bridge of Allan), A. C. Swindells (Manchester), B. H. Wainwright (Stalybridge), E. T. Yates (Manchester), Harry Richardson (Bradford), H. Pontefract (Huddersfield), W. Bosworth (representing The Oldham Technical Association and Old Students' Union), Cyril W. R. Cann (Plymouth), Abraham Lomax (representing Ainsworth Mercerising Co., Ltd., Bolton), James K. Kerfoot (Manchester), H. R. Briton-Jones (Giza, Egypt), John Brandwood (Bury), and J. Scrimgeour (Farnworth). P. E. Crompton-Smith (Manchester) was elected to Junior Membership.

THE INSTITUTE AND TEXTILE SOCIETIES

The movement directed towards co-operation on the part of the Textile Institute and Textile Societies has been advanced a further stage by the holding of sectional conferences during the past month—one at Bradford when representatives of various Yorkshire societies and of the Yorkshire Section Committee of the Institute met and discussed several items, and another at Manchester, when representatives of the Lancashire Section Committee of the Institute and of societies in Lancashire considered proposals. In the case of the Bradford meeting, it was decided that each organisation should exchange draft syllabuses of lectures as soon as completed. It was also agreed that textile societies should allocate one or more lectures each session to the Textile Institute, these lectures to be run jointly, the Institute to provide the lecturer after receipt of suggested subject from the society concerned and the society to provide the meeting-room accommodation. A sub-committee was appointed to prepare a panel or list of lecturers, and it was decided to deal finally with this matter at a general joint conference. In the case of the meeting at Manchester, it was decided that syllabuses, when complete, should be sent in to the General Secretary of the Textile Institute, so that a full list in order of dates might be prepared, printed in the Journal of the Institute, and reprints sent to the secretaries of the various societies. It was also agreed—even apart from lectures—that in the event of any society experiencing real difficulty in securing the services of a lecturer on a special subject the Institute should be asked to assist. A further decision was that each society provide each session for one lecture under joint auspices with the Institute, and, in cases where an Institute lecture was provided, the local society was urged to issue invitations to other organisations in the locality whose members might be interested. With regard to the proposed panel of lecturers, the societies are invited to furnish names of lecturers and subjects, full list to be retained at the Institute. An important suggestion arose towards the close of the meeting at Manchester—that an annual combined conference should be held for the discussion of various matters of interest to the industry. The meeting even provided an example of the kind of subject which might receive attention at such a conference by passing a resolution recommending to the Council of the Textile Institute the consideration of helping forward the movement for special instruction to mill overlookers, as inaugurated by Mr. W. Wilkinson, of the Blackburn Technical College, by an approach to the various cotton spinners' and manufacturers' organisations with a view to securing their sympathy and co-operation in the development of the movement.

TESTING HOUSE AND LABORATORY

A further stage has been reached in the gradual development of the Manchester Chamber of Commerce Testing House and Laboratory. Towards the end of 1921, the premises occupied since 1900 in the Royal Exchange buildings were vacated and more commodious premises were arranged for in the newly-erected and enlarged Exchange. The new premises have now been opened, and during the latter part of last month special visits of inspection were organised. Carefully planned with a view to facilitating the work undertaken, many conveniences have been introduced which, hitherto, were not available. Particular attention has been paid to the lighting, and, for the most part, large windows with North aspect have been provided. Electric power is employed for driving testing machines and other apparatus. The entire equipment, in fact, has been completely overhauled and important additions have been made. An illustrated brochure, descriptive of the activities and equipment of the institution, has been issued. In regard to the work of the Testing House, it is pointed out that whereas the intention of the founders was mainly to provide means whereby local firms might obtain official tests of cotton yarn, yet, to-day " cotton yarn testing constitutes but a small section of the institution's activities, which, in addition to practically every description of physical and chemical testing commonly applied to the different textile fibres, yarns, and fabrics, include the inspection of textile materials, the testing of wood pulp, and the analysis of various substances used in industry."

PRESIDENT OF THE SILK ASSOCIATION

Mr. Frank J. Farrell, M.Sc., director and manager of the firm of Messrs. Grout & Co. Ltd., silk manufacturers, Gt. Yarmouth, has been elected President of the Silk Association, in succession to the late Mr. H. G. Tetley. Mr. Farrell has, for many years, occupied a leading position in relation to the activities of the association named. He is deputy-chairman of the British Silk Research Association. When the Industrial Council for the silk industry was formed in 1918, Mr. Farrell was appointed as first chairman, and he remained in the office for two years. He has also contributed useful service as a member of the Advisory Committee on Silk Production.

BRAZIL AS A COTTON GROWING COUNTRY

The arrangements for the International Cotton Conference, which is to take place at Rio de Janeiro, Brazil, from the 15th to 26th October next, are evidently proceeding satisfactorily, and Mr. Arno S. Pearse, who is acting as honorary oversea member of the Executive Committee of the Conference, has been able to issue a programme which outlines subjects to be dealt with. Added interest is given to the fixture as a result of the existing cotton supply situation. Mr. Pearse, who accompanied the special Mission of Investigation in Brazil in 1921, has expressed the opinion that Brazil offers the most immediate possibilities for extension of cultivation, provided the necessary amount of individual enterprise can be secured to co-operate with the Brazilian Government. The forthcoming conference has arisen in consequence of a suggestion made by Mr. Pearse on the occasion of the visit of the Mission already referred to. The central idea of the fixture is to bring the whole question of cotton cultivation in Brazil to the attention of those interested, and the conference has been timed to synchronise with the Independence Centenary festivities in the Autumn of this year. The suggestion was warmly received and has been fully acted upon. The event is being organised by the National Agricultural Society of Brazil, and will be held under the auspices of the Brazilian Government. The question of Brazilian cotton supplies was discussed at the recent International Conference at Stockholm, and there was common agreement that Brazil offers great possibilities, not only from the point of view of short staple, but also of long staple cotton. A representative of the Brazilian Government attended at Stockholm, and, on behalf of the President of the United States of Brazil, pleaded for a good attendance at the forthcoming Rio conference of cotton spinners and manufacturers from various countries. He pointed out that the Brazilian Government alone could not successfully carry forward the suggested project, and it would be necessary, if really effective results were to accrue, to secure co-operation and advice from many directions. The subjects with which it is proposed to deal include the following :—(1) Cotton in Brazil : General Enquiry on cotton cultivation in the different Brazilian States and abroad ; (2) Improvement of cotton growing in Brazil ; (3) Diseases and Pests of cotton ; (4) Cotton of the North-Eastern States of Brazil ; (5) Ginning and handling of cotton and bye-products ; (6) Intensive cotton cultivation : The Federal Cotton Department ; (7) Classification of cotton and establishment of commercial types : Commerce of Cotton ; (8) The cotton spinning and weaving mills and internal consumption : Export of cotton goods ; (9) Economic defence of cotton ; and (10) Export of cotton and bye-products : Taxes and freights. Mr. Arno S. Pearse would be pleased to provide any further particulars relating to the conference on request.

WOOL TEXTILES AND UNEMPLOYMENT

America gives a lead which other countries might well copy in the compilation of a monthly return of active and idle machinery in the textile trades. Probably, the figures are not strictly accurate, but the margin of error cannot be great, and they furnish a much more reliable index to the condition of the industry than is provided by our own unemployment statistics supplemented by market reports. Especially in the manufacturing section of the wool-textile industry, these sources of information are quite fallacious. There is a large floating population of women who have been trained as weavers, but who can without serious hardship make themselves useful at home, and the extent to which they figure in the unemployment returns is doubtful. Moreover, in busy times, the running of the looms depends on a steady inflow of recruits to replace the large number who marry and leave the mill, and it is uncertain to what extent this inflow is now being provided for by the training of girls. It is quite possible that a large percentage of looms might be idle although there were no visible unemployment. A return of employed and unemployed machinery, giving, on the American model, the percentage of idle hours during the week or month, would exhibit the condition of the industry with reasonable accuracy. In this respect, the market-reports published by local newspapers and trade journals are not of real value, and, in fact, such reports are mainly devoted to the combing and spinning sections of the industry. The estimates which are published from time to time of the number of looms running are the merest guess-work, though of course the few men who are thoroughly conversant with all sections of the trade may now and then make a good guess. There is, naturally, a strong prejudice among manufacturers against giving information of the kind suggested, especially when trade is bad, but there should be no difficulty in maintaining absolute secrecy as to the returns made by individual firms.—F. J. N.

THE FRENCH TARIFFS.

Mr. Streat, the Secretary of the Manchester Chamber of Commerce, did a little useful propaganda work when recently in Paris on business connected with international arbitration. In brief, he had an interview with the Minister at the Commercial Department of the French Foreign Office, and in a friendly and unofficial way discussed with him the high rate of duty charged on cotton goods entering France. In the course of the conversation, it was pointed out to the Minister that there was objection in Lancashire to the unduly high level of the duties and to the continuance of the system of "co-efficients of increase," in view of the fact that more normal prices now obtained. M. Seydoux, the Minister in question, promised to look into any figures submitted, and, as a consequence, data compiled by the Manchester Chamber of Commerce was promised him, by way of an unofficial communication to be sent without delay. A similar interview was obtained with M. Serruys, the Chief of the Tariffs Department of the French Ministry of Commerce. Out of it, it is to be hoped, good will come. —R. C.

IN LIGHTER VEIN.

The long depression notwithstanding, the textile industry can still find bright spirits and an outlet for them. As an illustration, the finishing trades have found ways and means to combine business with pleasure—on the golf links. In stricter fact, what is happening is a series of tournaments on the greens, in which dyers will meet bleachers, the bleachers will meet the finishers, and so on through the round of the finishing sides of the industry. The idea seems to have gathered momentum, and out of it has come a competition for the dyers for a trophy presented by Mr. Vernon Clay, whilst the bleachers will have a friendly tussle for a cup given by Mr. Henry Allen. The idea might be carried still further. There might be competitions between the finishing sections and the spinning and manufacturing sides; it may all help to foster better feeling in the trade. And next time we have a World Cotton Conference on this side a golf competition might very well be introduced in the lighter side of the programme. It is sometimes said that golf to-day is more of a business than a recreation. Why not bring it into business properly and use it to develop the amenities of commercial life? That is the question which would appear to be suggested. —R. C.

GENERAL ITEMS AND REPORTS

MANCHESTER ASSOCIATION OF IMPORTERS AND EXPORTERS

The annual report of this Association is a useful document recording outstanding events of the past year as affecting international trade. It is observed that the economic recuperation of this country largely depends on the sane and healthy condition of the international situation, which requires confidence and co-operation in all spheres of activity. The report contains a particularly well-balanced review of overseas trade and a critical analysis of statistical returns of imports and exports. Shipping and rates of freight are brought under review. The membership of the Association at the end of the past year totalled 381.

ANNUAL REPORT OF BRITISH COTTON GROWING ASSOCIATION

The seventeenth annual report of the Council has been published in pamphlet form (price 6d.) and covers the work of the Association during the year 1921.

The report states that it is not surprising, owing to the deep depression the cotton industry has passed through during the last two years, to find that the consumption of cotton in the United States during 1921 was 1,232,000 bales less than in 1920. At the same time, the total commercial crop for the 1920-21 season was only 11,175,000 bales, as against 12,252,000 bales for the previous season. The quantity of cotton shipped direct from the United States across the Pacific to the Eastern markets is rapidly increasing and is making an appreciable difference in the visible supply of cotton when stocks are low.

The shipping facilities for cotton during the year have been very satisfactory, and the cotton is now coming forward from the various Colonies with less delays than for some years past, whilst, as a result of representations made to the steamship companies, further substantial reductions have been made in freight charges.

It is recorded as satisfactory that African cotton is now in better favour with Lancashire spinners, and now that the different qualities have become more widely known there is a greater demand for the cotton.

The report also deals with the work accomplished in the Colonies, etc., and with regard to the West Indies it is recorded that the planters are complaining that they find it difficult to produce Sea Island cotton at a profit even when it is possible to sell at 27d. to 30d. Notwithstanding the fact that the pink boll-worm now exists in a number of the Islands for its second season, it appears that under the conditions of soil and climatic characteristic of certain of these Islands fairly satisfactory crops of cotton can be produced. The steps taken by the Imperial Department of Agriculture to combat the pest have been most commendable.

The native cotton industry of the Southern Provinces of Nigeria is reported to have been in a very healthy condition, whilst the cultivation of the improved long-stapled cotton in the Northern Provinces continues to show a steady increase. Efforts are being made to revive the native cotton-growing industry in the Muanza district of the Tanganyika Territory, but, unfortunately, the quality of the cotton is rather inferior—due to inadequate methods of seed selection and in grading. In Rhodesia, the agricultural authorities continue hopeful but not over-sanguine as regards the future of cotton-growing, but a number of experiments are being carried out in various districts.

In dealing with Mesopotamia, the report states that, owing to the unsatisfactory political situation which still exists, it has not been possible to adopt any progressive policy. There was a better demand for seed for planting for the 1921-22 crop, and, although progress will necessarily be slow, the prospects for the future are undoubtedly much brighter.

The development in Queensland during the year has been very satisfactory, and the latest reports are to the effect that 20,000 acres are already being cultivated, which should result in a crop of at least 8,000 bales.

The increased cotton production within the Empire during the year—in Uganda, Nigeria and the Sudan—is very gratifying, the report concludes, and, although temporary set-backs are inevitable, there can be no doubt but that the industry in these countries is now firmly established, and that, as larger areas are opened up by transport facilities, the quantities of raw material available for Lancashire spinners and manufacturers will steadily increase.

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PROCEEDINGS

YORKSHIRE SECTION

Meeting at Bradford, 23rd March, 1922, Mr. John F. White in the Chair.

WOOD FIBRE YARNS AND FABRICS.

By R. W. SINDALL, F.C.S.

INTRODUCTION.—The manufacture of yarns and fabrics from wood pulp fibres has attracted considerable attention since 1914. The difficulty experienced by Germany in obtaining jute for sandbags during the war, was perhaps the stimulating cause which led ultimately to an enormous expansion of the wood pulp textile industry.

The yearly quantity of jute imported into Germany and Austria prior to the war was about 160,000 tons, then valued at £8,000,000,[1] and the cutting off of these supplies was the first step in the application of wood pulp to many purposes. In 1914, there appear to have been only two paper yarn factories at work in Germany, but at the end of 1917 there were 250, and in Austria about 300. The production of yarn was probably 250,000 tons per annum. Such production, coupled with the heavy demand for wood pulp for explosives has had a serious effect upon the supplies of paper for printing.[2]

HISTORICAL.—The use of wood pulp for the production of yarns and fabrics offers by no means a new suggestion, for in 1890 Mitscherlich patented a process in which thin sheets of wood were passed between corrugated rolls to crush and tear them into fibrous splinters. The sheets were softened by boiling in water or digesting with sulphurous acid solutions and the incrusting non-fibrous constituents of the wood loosened and partly removed. The filaments obtained were spun by the usual processes, but they were coarse aggregates or bundles of fibres, since the treatment was not sufficiently drastic to resolve the wood into ultimate fibres.[3]

In 1892, Türk invented a process by means of which the wood pulp fibres isolated by suitable chemical treatment were consolidated into endless strips on a cylinder machine and spun in a wet condition. These yarns were called by the trade name " Cellulon."

In 1895, Claviez introduced a system having dry paper prepared from wood pulp as its basic raw material. The yarns were known as " Zylolin."

In 1901, Kron adopted the used of special water jets to divide the wet web of paper made on the Fourdrinier paper machine into numerous endless strips of the required length. The yarns were technically known by the name " Silvalin."

The various operations now in use are based upon these processes.

KELLNER TURK SYSTEM.—In this system the process starts with a raw material in the shape of soda wood pulp. This, prepared by the process described elsewhere, is mixed with the requisite amount of water and pumped into the supply box of a machine technically known as the cylinder mould machine. The box is a large square reservoir in which rotates a hollow cylinder, the surface of which consists of fine wire cloth of 50 to 60 mesh. As this cylinder rotates, the water mixed with the pulp passes through the wire cloth, and the suction so produced causes the pulp to form a thin skin on the surface. As the drum rotates, the skin is brought out of the reservoir and comes into contact with a travelling felt or cloth passing over a roller. The water is discharged from the centre of the drum and a continuous skin of pulp is formed from the pulp. Over the wire cloth of the cylinder are soldered copper rings about 2 mm wide and set about 4 or 5 mm apart so that the cylinder consists of alternate solid strips and bare wire cloth strips. The result is that the continuous skin of pulp is in effect broken up into a series of narrow wet strips. The travelling felt carries the sheet of pulp forward, a large proportion of the excess of water being drawn away by means of vacuum boxes. The travelling felt, containing firm, adherent strips on its surface, passes through press rolls which remove still further quantities of water and serve to compress the papers into more coherent and dense strips. The strips are then further dried, but not completely, by means of steam-heated cylinders and subsequently wound up on suitable rollers. This process is said to give a stronger thread than is obtained by other processes.

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[1] Jl. S. Chem. I., 1917, 287, and 1918, 106R.
[2] Bd. of Trade Jl., Sept. 12, 1918.
[3] Pfuhl, " Papierstoffgarne," 17.

Varlot[4] states that the strength of the yarn made in this way depends on various factors, the chief of which is the ratio of the diameters of the fibres to their length, which must be as small as possible to obtain the maximum felting power. The tenacity and flexibility of the finished yarn is determined by spinning all the strips in their wet condition. He gives the following figures showing the comparative strength of various threads :—

Length tested—300 mm.	Wet Pulp Thread (tested bone dry)	Dry Paper Thread (tested bone dry)	Cotton	Jute
Weight of 10 mm. of thread .... grms.	2·298	3·015	0·698	2·094
Strength in kilos, mean of 5 tests	1·09	1·60	0·29	3·34
Breaking length in metres	8776	5307	4155	15950

KRON PROCESS.—Instead of adopting a cylinder mould machine as used by Türk, Kron conceived the idea of dividing the wet web of pulp made on the ordinary Fourdrinier paper machine. For this purpose, fine jets of water directed parallel to one another are allowed to impinge on the surface of the broad web of pulp, still wet and adherent, so as to produce longitudinal furrows. The narrow, loosely formed strips of wet pulp still adhere together by thin layers of pulp left between them, as the water is carefully regulated to allow some of the fibres to remain between the strips for this purpose. The jets of water are not directed with any force or at any great height from the surface of the wet pulp.

The employment of fine jets under high pressure was found to be impossible owing to the irregular clogging of the openings, and the choking of the wire cloth due to the fibres being driven into the meshes. These difficulties were surmounted by bringing the water through small tubes close down upon the web of pulp under sufficient pressure to produce the strips without complete separation. The disturbing force is thus limited to the line of contact between the strips. The sub-divided web is compressed and solidified by the action of press rolls and the moist material run off on rollers. It passes continuously over a number of drying cylinders to remove a large proportion of water. The partially dry strips are run off on to a magazine roll, as it is termed, containing a number of damp pulp discs which can be separated readily.

THE CLAVIEZ PROCESS.—The first machine used in the process of spinning wood fibre is a splitting machine for cutting up a dry reel of paper into a number of discs of small widths. The paper is fitted on bearings at the back of the machine in the form of large reels about 30in. wide containing 3,000—5,000 yards of paper. This is cut into strips of the required width which may vary from one-sixteenth of an inch to one inch according to the fineness of the yarn required. The paper is drawn through two feed rollers to a second pair of rollers, each provided with cutting discs set the required distance apart. The cutting edges of the disc are in close contact, so that while the paper is being cut the knives are kept quite sharp. The cut strips are wound up on two ordinary rollers, the odd numbered discs going to one roller and the even numbered discs to the second. By this simple device, the original reel is cut up into a large number of narrow width reels which can easily be handled. In some cases, the paper, before being cut, is passed through a bath of water to which can be added, as required, any chemical needed to improve the quality and strength of the spun yarn.

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[4] Varlot—"La Papeterie," Jan., 1920, p. 5.

SPINNING THE PAPER.—The strips of paper are now ready for spinning. The machine used is practically that employed in the process of spinning jute, with minor adaptations to make it more suitable for the spinning of the paper strips. The strips of paper are suitably mounted on upright bearings fixed on the top of the spinning frame. If the paper has not been previously damped in the process of cutting, the strips from the discs pass over rollers rotating in a trough containing water or chemical solution so that sufficient moisture is imparted to the paper to ensure correct spinning. The paper is drawn through tension bars and then spun on to bobbins by the ring and traveller method. It is stated that a speed of over 5,000 revolutions per minute can be obtained. For convenience in doffing and piecing up the threads a hand stop motion is attached to each spindle.

A different form of spinning machine is utilised by the Textilose Manufacturing Co., of Manchester. The reeled discs from the cutting machine are placed horizontally in circular pans. The inner ends of the strips are led up to bobbins through suitable apertures, the twist being effected by the rotation of the pans. The twisted yarn passes through a pair of slowly rotating leather belts which further roll, compress, and polish the yarn, which is then wound up into the form of cheeses. The cheeses or bobbins are then converted into cops for weaving in the usual way, the processes and machines being practically those employed in the treatment of coarse, long fibres, such as hemp and jute. They are also adjusted on the V-creel and wound up in the form of a web for weaving.

In the weaving of goods—such as mats, carpets, and rugs of simple pattern—a border effect is obtained by inserting in the warp some threads spun from coloured paper. The lengths of carpet or similar goods are then put into a guillotine and cut off to the required size, the ends of the fabric being fastened by hand with jute or hemp webbing.

" DRY " SPINNING.—In all the processes so far described the strips of paper of convenient width, determined mainly by the thickness of the yarn required, are damped with water or with solutions containing chemicals, either during the cutting process or while being spun. This moisture is added mainly to facilitate twisting and to produce a denser, more coherent thread.

A method has been recently devised for dry twisting and is now in operation at Stratford, London, under the direction of the patentee, Mr. Harley. The spinning machine embodies the principle of unwinding in an upward direction through a spool revolving at high speed. There are no flyers or travellers, the yarn being taken up by a haul-off drum and wound on to double-flanged bobbins by means of a slow traversing guide. The paper strip in the form of a tightly wound roll from the cutters is adjusted between two flanges of a rectangular frame. The frame is rotated by bevelled gears on the lower end and the strip is drawn upwards through the top bearing. This produces the required twist, and the speeds of the drum and the rotating cages are carefully adjusted so that a uniform amount of twist is guaranteed. The yarn leaving the bearing of the rotating cage passes through a small compressing die which is the chief feature of the new process. The paper is thus more evenly compressed into a regular, well-rounded, polished yarn, free from knots and of uniform diameter. The finished yarn in a dry condition passes over the haul-off drum, around which several coils are passed in order to prevent slipping, and ultimately wound up on bobbins in the usual way. The patentee states that dry twisted yarn, with its special evenness of diameter is particularly suitable for piping for hat bands, corsets, upholstery, coach work, and motor cars, and there appears to be a great demand for the material in this direction.

It is hardly correct to describe the various goods exhibited—(the author exhibited a wide range of specimens)—as "paper yarns and fabrics," though this is the popular term applied. The term covers a wide range of domestic and commercial applications of the material, such as sacks, handbags, wall tapestries, clothes lines, carpets, hearth rugs, twine, pipings for hats, upholstery, corsets, motor-car fittings, railway-carriage cushions, webbing, chair canvas, belting, &c. But these articles cannot be manufactured from any kind of paper. The only material suitable is that known as soda woodpulp fibre, which is utilised direct in the wet state for the Türk process, or in the dry state for the Claviez process, being supplied as finished paper known by the name of "kraft" paper. This is made from wood by a special method and is characterised by its extraordinary strength and elasticity. Some idea of its strength may be gathered from the fact that a strip 1in. wide will support a weight of 45 to 50 lbs. Expressed in another form this means that a kraft paper has a breaking length of 12,000 metres—that is, a strip of any given width, if suspended, must be 7 to 8 miles long before it will break of its own weight at the point of suspension. The term "kraft" is a German word meaning "strength," and is aptly applied to this well known class of paper. A few words on the method of manufacture will be needed.

MANUFACTURE OF SODA PULP.—The best quality of "kraft" pulp is made from soft woods, such as spruce, pine, and fir. The wood, previously denuded of its bark, is cut up into short pieces 2 feet in length. These pieces are passed through a chipping machine which cuts the logs into small chips about one-eighth of an inch thick and one to two inches square. The chips are charged into a horizontal cylindrical vessel supported on suitable bearings erected over a tank. The required quantity of chemical solution is then run into the digester consisting of a mixture of caustic soda and sulphate of soda. The mixture is heated by steam and the process of boiling conducted for 4 or 5 hours at a pressure of 60 to 70 lbs.

The gummy and non-fibrous constituents of the wood are thus more or less completely removed and the wood is converted into a soft, fibrous mass. If the process of digestion is carried to an extreme by the use of strong solutions, high pressure, and prolonged time, the non-fibrous constituents are almost completely removed, leaving a soft, pure fibrous pulp known as cellulose. If, however, the process of digestion is less severe and only carried on under conditions which leave a good deal of the gummy, non-fibrous substances in the wood, a totally different product is obtained, which ultimately yields "kraft" pulp.

By a careful regulation of the kind of treatment so as merely to produce a softened wood, in preference to a soft, well-boiled material, a fibre eminently suitable for "kraft" paper is obtained. The partially cooked and softened wood is then submitted to the action of edge runners, a machine very similar to the mortar mill in which heavy circular stones revolve in contact with a horizontal fixed stone. The partially boiled wood is thus more completely disintegrated by the mechanical rubbing action of the stones.

This special treatment imparts the peculiar qualities of the "kraft" paper and these would be completely lost if the digesting conditions are too drastic. The pulp in this condition is carefully washed and can then be utilised at once for the Türk process, or it can be converted into finished "kraft" paper for the Claviez process.

FIBROUS CHARACTER OF WOOD.—The radical difference between long-fibred material, such as flax, hemp, and jute used for spinning, and the fibre obtained from wood, can most readily be judged by a superficial examination of the samples of wood pulp available for inspection. The various wood pulps manufactured for papermaking may be classified under three heads.

The first is *mechanical wood pulp*, so called because the wood is disintegrated into fibres, or more correctly fibrous aggregates, purely by mechanical means.

The logs of wood, freed from their bark and cut to a length of 24 inches are pressed up against the face of a revolving grindstone entirely surrounded by an iron casing. Projecting pockets are fixed on to the casing and serve to retain the pieces of wood which are pressed against the surface of the stone by means of hydraulic pistons.

A continuous stream of water flows on to the stone and carries away most of the disintegrated pulp, which is subsequently screened to remove the coarse chips and *slivers*, this being a term applied to the coarse fibrous aggregates which cannot be used for papermaking. Pulp of this kind has little felting property and its use is confined almost entirely to the production of cheap newspapers and printings, box boards, cheap cards, and similar purposes.

The next quality of wood pulp is that known as *chemical wood pulp*, so called because the processes used for isolating the fibres require the use of certain chemicals.

The *sulphite* process is based upon the treatment of chipped wood in acid resisting digesters with a solution of bi-sulphite of lime, the cooking operation being continued for some 7 to 8 hours at a pressure of 80 lbs. per square inch. The whole of the gummy and non-fibrous constituents of the wood are dissolved to the extent of 50% of the weight of wood treated. The resulting mass is a pure white, soft, fibrous cellulose which, after screening and washing, is ready for conversion into paper. Such a pulp, consisting of almost pure cellulose, produces a high-class paper and finds many applications.

The third quality of wood pulp known as soda or *sulphate pulp* is obtained by treating chipped wood in suitable digesters with caustic soda by methods already described.

In Germany and Austria, both the wet and dry processes of the manufacture of yarn are used, but in England the yarn is manufactured exclusively from dry " kraft " paper imported from Sweden. The reasons for this are perhaps obvious, in that Germany and Austria are provided with pulp mills in which the original wood can be converted into pulp, but in England no pulp mills are available for the manufacture of the pulp. Hence, the spinning process is entirely confined to operations arising from the use of the finished paper. It is best to remember that, in one sense, the paper is merely incidental to the process.

TEXTILE FIBRES V. PAPER FIBRES.—A simple experiment enables the observer to notice the difference between the fibres. If a piece of ordinary jute rope or cotton thread is untwisted by hand, the length and character of the fibres is easily seen. The nature of wood fibres in respect to general appearance and length can be observed most readily by rubbing down a small piece of blotting paper and examining the fibres in a considerable quantity of water in a glass tumbler. The spinner is dependent mainly on the length of his fibre and produces tensile strength in the yarn by a mechanical process of spinning the fibres together so that the adhesion is mainly one of physical contact between the fibres. The papermaker may use the same identical raw material, as, for example, cotton, in the manufacture of high-class rag paper, but it is essential in the process of manufacture that the purely mechanical adhesion of fibre to fibre in reduced length should be supplemented by cohesion arising from a curious operation through which the fibre is passed known as beating.

BEATING.—The beating process imparts certain qualities to the shortened fibre through a curious action to which is given the name *hydration*. In some way, the fibre assimilates the water and assumes physical characteristics immensely divergent from those of the original fibre. This can be illustrated by making sample sheets of paper from wood pulp which has been beaten for varying periods of time. The sample shown, in which soda pulp has been beaten for ½ hr., 1 hr., 2 hrs., and 3 hrs. respectively, illustrate the effect which is demonstrated here by the shrinkage of the sheets produced when allowed to dry in the air. The original sheet of pulp, made on a hand mould, measured 46 sq. ins., after beating the paper made from the pulp for half an hour, it measured 40 sq. ins., one hour's beating reduces the area to 34 sq. ins., 2 hrs. to 32 sq. ins., and, finally, the treatment of the pulp for 3 hrs. gives a shrunken, horny mass, having an area of only 19 sq. ins.

The felting of these fibres to produce a sheet of paper takes place in a very simple manner as may be illustrated by the experiment of making a few sheets of paper on a hand-mould. (The process of making sheets of paper by hand mould was here demonstrated).

The modification of the hand mould process for the manufacture of a continuous web of paper was devised in 1799, and with the present Fourdrinier paper machine, so named from the inventor, the paper is now produced in rolls of any length. A mixture of pulp and water in the necessary proportions flows in a thin, even, stream on the horizontal wire cloth, and as the wire travels forward the thin skin of pulp is formed on the surface and the water drains away to the underside of the wire. Further quantities of water are removed by suction boxes under the wire and by rollers which compress the fibre and squeeze out the further excess of water. The sheet passes on to the drying cylinders and is eventually wound up in the form of a dry reel of paper.

STRENGTH OF PAPER YARNS.—The experiments of 1904 made by Professor Pfuhl indicated that the yarns made from pure wood fibre have a mean breaking length of 5 to 7 km, with an elongation factor of 6 to 7%. These figures indicate qualities good enough for the utilization of wood fibre for special purposes, though the finished fabrics have practically only one-half the strength of jute fabrics of the same make and weight.

A comparison of the strength of ordinary spun yarns as compared with paper yarns is shown by the following table[5] :—

	Breaking length (kilometres)	Elasticity
Cotton yarns	13—14	3·97
Ramie yarns	11—12	0·8—1·8
Flax yarns, wet spinning	12·4—19·5	1·1—1·8
Flax and tow yarns, dry spinning	11·8—12·4	2·5—3·7
Jute yarns	9·9	2·0
Lustra cellulose average	12·0	2·0
Artificial silks, extremes	8·0—14·0	7·0—18·0
Rag papers and wood pulp papers	4—8	3·8
"Kraft" papers	8—10	4·0

The effect of the spinning treatment which results in a denser and more solid product is to give a higher resistance in terms of breaking length, as shown by the following figures :—

	Breaking length (kilometres)	Elongation per cent.
Plain strips, dry	4·17	2·84
Rolled cylindrically	5·18	2·71
Rolled and twisted	6·41	3·06
Kron's process yarn	5·5	6·8
Türk's process yarn	6·16	7·71

Some figures recently given by Mr. Harley of Harlspun Ltd., are interesting in this connection. A 3-ply clothes line, having a breaking strain of 190 lbs. when first manufactured, was put into use for 12 months, and the tensile strain was found to be 223 lbs., after continual wear.

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[5] Cross and Sindall—"Woodpulp and its Uses," p. 233.

Mr. Harley states that the form in which the yarns are twisted has an important influence on the tensile strength but that the results are contrary to that experienced with cotton. For example, an 8-ply cotton yarn is stronger than a 6-ply cotton yarn for the same weight. With paper yarns, the opposite result is obtained. In one case, a 6-ply cord made of yarn produced from strips 7 mm wide giving a total of 42 mm of paper, had a tensile strength of 22·6 lbs., whereas a 4-ply cord made from yarn produced from strips 10 mm wide giving a total of 40 mm of paper, had a tensile strength of 33·8 lbs. This is an interesting fact and the suggestion therein should be followed up by further experiments.

The important fact remains that when all the factors relating to the tensile strength of wood fibre yarns are taken into consideration, the prospects of a large commercial industry in wood fibre yarn cannot be based entirely on the tensile strength of the yarn itself. In the first place, the yarn is only one-half the strength of jute of the same weight, and the temporary decrease of strength produced when the yarn is wetted is a serious drawback; it is true that on drying out again the original strength is restored.

Mr. Griffin makes the following interesting remarks about a suit of clothes[6]:—"Some of the characteristics of a two-piece workman's suit which I happen to have are as follows:—The cloth is of a coarse weave count 30×9 and differs from plain weave in that the web threads are in pairs while the weave is single ply. This gives just double the strength in the web direction. The tensile strength dry was 75 pounds to the inch lengthwise and 37 pounds crosswise. After wetting out these tests fell to 59 pounds and 26 pounds, which recovered after drying to 72 and 33 pounds, showing that, by careful handling in washing and avoiding rubbing, such paper cloth will stand considerable handling. The two-piece suit weighed 3¼ lbs. and gave the appearance of weightiness. The weave was open, making a porous cloth which was very stiff. The cloth was navy blue and the garments were cut out, sewed, and finished in places with strips of cotton cloth in the ordinary fashion."

The addition of certain chemicals to the bath used for moistening the yarn is said to improve its tensile strength. Impregnation of the strip before twisting, or of the yarn while being spun, is effected by passing it through a bath containing glue, tannin, and silicate of soda at 50°C without drying. The moist yarn is then further passed through a cold bath of basic aluminium formate and dried more or less completely. The tensile strength of the yarn is increased some 10% when dry and 30% in the wet state.

Massot states that treatment with tannin precipitated by glue imparts a considerable increase of strength and elasticity[7].

Treatment with 1% tannin solution gives a soft, pliable feel, and increases the strength by 49% and also has a favourable influence on the strength in the wet state. Tannin solution fixed with gelatin gives a hard, string-like feel, increases the strength by 25%, and reduces the loss of strength on wetting to only 15%. Tannin solution fixed with neutralised aluminium acetate gives a strong elastic feel, and the strength is increased by 44% whilst the loss of strength in the wet state is 22%.

The activity of the manufacturers during the last few years has been devoted to an improvement of the yarn in the direction of durability, water-resistant properties, and tensile strength by impregnation with all kinds of chemicals such as resins, casein, formaldehyde, stearin, mineral oils, creosote, and sizing agents.

Thanks are due to the following firms for providing sample exhibits:—The Textilose Manufacturing Co., of Manchester; Harlspun Ltd., Stratford, London; and S. W. Hymans, Ltd., of Bradford.

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[6] Paper and Pulp Magazine, Dec. 2nd, 1920.
[7] Jl. S. Chem. I., 1917, p. 543.

NOTES AND NOTICES

CHAIRMAN OF INSTITUTE COUNCIL.

At the last meeting of the Council of the Institute, Mr. John Crompton was unanimously elected chairman for the ensuing year, whilst Mr. John F. White, the retiring chairman, was warmly thanked for his services. The election of Mr. Crompton formed a fitting recognition of the keen interest which he has taken in the organisation from its very commencement. He has devoted unsparing energy to many of the activities in which the Institute has engaged, and has served on many committees, whilst his outstanding achievement has been the creation and establishment of the Lieutenant Harry Dent Crompton Prize Scheme under which the Institute offers £100 each year as prizes in a competition for advanced students in design, structure, and colour of woven textile fabrics. Mr. Crompton contributed to the Institute an invested sum of £2,000, the annual revenue from which provides the prizes offered, the whole scheme forming a memorial to his only son, who fell in the war. A pioneer in the matter of textile technical education in Lancashire, Mr. Crompton has been in the forefront of the developments which have gradually taken place in this connection, and of late years his services in an advisory capacity have been enlisted in many directions. His election as Chairman of the Council of the Institute came at an appropriate juncture in his career, inasmuch as he has since had conferred upon him the honorary degree of M.Sc. (Tech.) in connection with the University of Manchester. To the vice-chairmanship of the Council of the Institute, Mr. Ernest T. Holdsworth, of Bradford, was unanimously elected, this election also forming a recognition of services, Mr. Holdsworth being the Honorary Secretary of the Yorkshire Section of the Institute, in which office he has served with unremitting zeal.

THE INSTITUTE AND GRANTING OF FELLOWSHIPS.

Mr. John Emsley, J.P., the President of our Institute, is actively proceeding in the matter of reviving interest in this question. A considerable time ago the Council of the Institute appointed a special committee to consider the whole subject, and, although several individual members prepared useful reports, and much useful information was got together, yet delay arose largely as a result of a somewhat general conclusion that a greater strength of membership of the Institute was highly desirable in the first instance. The President, however, invited the members of the special committee to meet him at luncheon on the 4th July, and it was then decided to convene a further meeting of a few members of the committee with a view to preparing definite proposals. As to membership strength, the President has already taken action, and, in the first instance, has made a direct appeal to existing members to secure at least one additional member each. So far, a fairly good response has been secured, and it is at least satisfactory to note that the effort has been far more successful than previous efforts of a similar character. In connection with the matter of the proposal that Fellowships should be created, it has been suggested that the Institute should endeavour to secure a Royal Charter. The President is taking the keenest interest in this matter, and it is on this account that he is most anxious to bring about a vastly increased membership of the Institute.

JOURNAL OF THE INSTITUTE: EARLY ISSUES.

The stage has now been reached at which copies of the earliest numbers and volumes of the Institute *Journal* are in frequent demand for the purpose of making up complete files. An advertisement appears in this issue in which the advertiser seeks to secure complete copies of Vols. I. to VIII. The back numbers involved might be contributed to from the Institute itself, but a complete spare set cannot be supplied. In this instance, the requirements is in respect of an institution, and any member who could conveniently dispose of a complete set of journals (Vols. I to VIII.) is asked to communicate with the General Secretary.

THE CALICO PRINTERS' ASSOCIATION.

It is welcome news that the Calico Printers' Association have decided that any future expansion of their activities must take place in Lancashire and not in India. Perhaps not until the announcement to this effect was made was it known, certainly not widely known, that the C.P.A. had had experts out in India investigating the conditions there, and it was after consideration of their report that the decision was taken. Lancashire, therefore, wins, though it would appear that the balance is not very heavily on her side. At the same time, it should be observed that all this business of a prospective opening up in India has reference to expansion—not to the transference of the present or even any proportion of the present establishment of the C.P.A. Something to the contrary has been read into the announcement; there has been a tendency to interpret it as meaning that sooner or later the concern might have moved abroad had the report been in other vein. That, of course, is absurd. The printing trade, in common with all the trades that go to make the allied industries in the cotton world, must be where production is, and first and foremost production is in Lancashire and likely to stay here. Moreover, it has to be observed that more and more the cotton trade is depending upon the allied sections for giving marketable value to the finished piece. That was made visible and evident at the recent exhibition of yarns and fabrics held by the Textile Institute, and the truth of it is more and more penetrating the trade. On the finishing side, there have been great developments; all the signs point to still greater developments, but they can only happen, or they can best happen, when the finishing processes are in the closest touch with the manufacturing processes. —R. C.

INDUSTRIAL WELFARE LECTURE CONFERENCE.

A provisional programme has been issued in respect of the Lecture Conference promoted by the Industrial Welfare Society (51, Palace Street, Westminster) and fixed to take place at Balliol College, Oxford, from the 15th to 20th September. This year the Conference will also be open to lady delegates, and arrangements for their accommodation have been made at Lady Margaret Hall, Oxford. A circular issued by the Conference Secretary (Mr. Chas. Cullen) states that these conferences have been much appreciated throughout industry, because it is felt that they enable managements, supervisors, and others interested in the movement to get into close touch with the most recent thought and developments regarding industrial welfare. The fee for attendance, including board and lodging and conference report, is 75s., payable in advance. The programme shows that on Friday, the 15th September, there will be an opening address, whilst on the next day there will be half-a-dozen short papers by supervisors. On the Monday and Tuesday there will be special papers and sectional meetings according to trades, whilst on the Monday afternoon a Women's Session will be held. The list of papers includes:—"Welfare under the Whitley Principle," by R. A. Austen Leigh; "Health and Welfare in Coal Mining Industry," Frank Hodges; "Record Keeping and Statistics," H. M. Vernon; 'Health, First-aid, Safety," Mrs. Carney; "Canteens," A. F. Agar; "Superannuation and Pension Schemes," J. Howard Robertson.

NOISE IN WEAVING SHEDS.

The problem of reduction of noise in weaving sheds has received a good deal of consideration on the part of the Research and Inventions Committee of the Institute. A preliminary report was issued in the latter part of 1920, and it was agreed at that time that more definite ascertainment was desirable in respect of the measure of contributory causes. The Manchester College of Technology has been approached with regard to the possibility of investigation, and it was reported at last meeting of the Committe,e named that the matter was under consideration at the College. The question has previously arisen as to whether any material diminution of noise could be effected by insulation of a loom from the floor, by means of rubber. In this connection, a member of the Committee submitted to last meeting the following note in reference to an experiment carried out:—

"Two jacquard looms were erected in a room removed from other looms and one was bolted down in the usual way, whilst the other was insulated in such manner that there was no metallic connection between the loom framing and the holding-down bolts. The floor was of wood. The nature and the amount of the noise produced by the two looms was judged by running them alternately and listening to the effect, both in the same room and in a room below. Although it is to be regretted that no appreciable difference was noticeable as between the two looms, yet it is hoped that even this "negative" evidence may be regarded as of interest—at any rate to any who would have expected insulation of this kind to reduce noise appreciably or who might contemplate making similar experiments."

ARE TEXTILES TOO DEAR?

The statement is frequently made that our foreign customers cannot afford to pay the prices now demanded for textile goods, and that this especially applies to the great agricultural countries, which are not, it is alleged, receiving proportionate prices for their produce. The wheat-grower's income, clearly, must be reckoned in bushels of wheat, and if the price of wheat falls he has less money to spend on clothing; if, meanwhile, the price of clothing rises, his family must make their clothes last longer. Prices must always tend to establish an ideal relation in which the textile worker will get as good food, and the farm labourer be as well clad, as our social economy will permit. How far are we from that relation at present, and in what direction is the change likely to be? So far as the prices prevailing in this country may be taken as a test, the agriculturalist has little to complain of, at any rate as compared with the time immediately before the war. The index figures of the price of commodities published by *The Economist* show that if we take 100 to represent the price-level of each group of commodities in July, 1914, the mean level for the last six months would be represented in the case of textiles by 172 and in the case of cereals and meat by 173, while the figure for all commodities is 169. During the six months the figure for all commodities has varied only between 168 and 171, while cereals and meat varied from 160 to 184, and textiles varied from 168 to 184; and the end of June found the textile figure at its highest. It has since declined, however. It is true that in 1914 the prices of textiles were relatively high, as compared with the average of those prevailing in the five-year period (1901-5) which *The Economist* takes as the basis for its index number; but that period was in some ways exceptional, and there seems to be no reason for regarding the proportions which then obtained as ideal. —F. J. N.

GENERAL ITEMS AND REPORTS

DER PAPIER-FABRIKANT FEST—UND AUSLANDSHEFT, 1922.

A copy of the above volume has been received. While most of the articles relate to the manufacture of paper the following are of interest to the textile industry and are abstracted in the Abstracts Section of this issue (See Sections 1C, 4E, and 6) :—The Technical Use of Chlorine in Isolating Plant Fibres; Steam Consumption in Drying Chambers; Estimation of Wood Cellulose by means of Chlorine in Carbon Tetrachloride; Sulphate Cellulose Production. Copies of the volume can be obtained from the Verlag Otto Elsner, Berlin S 42, Oranienstrasse, 140-142, at the following prices :—Germany, 50 marks; Belgium, 10 francs; Switzerland, 5 francs; Italy, 15 lira; Spain, 15 pesetas; England, 4/6; U.S.A., 1 dollar; Scandinavia, 4 kronen. —L. M. S.

MEDICAL SUPERVISION IN INDUSTRY.

At a meeting of the Industrial Welfare Society held at the Midland Hotel, Manchester, on 26th June, the Chairman, Mr. F. J. Marquis said that those responsible for drawing large numbers of people together and causing them to work in more or less confined spaces had also a responsibility for securing that those with whom they were associated were healthy people, so that by association with each other they would not deteriorate physically. Also, if maximum production was aimed at, employers should take very careful measures to see that the people were capable of producing the maximum. His own experience had been that since a doctor had been introduced the workpeople had been more healthy; healthy people had been introduced, and incipient disease had been checked.

Dr. D. A. Coles, Medical Officer to the Gas, Light and Coke Co., Ltd., London, and Chairman of the Industrial Welfare Society briefly outlined the scope of the functions of the Medical Supervisor of a factory, and instanced the selection of sites, erection of works, selection of entrances and exits, general drainage, water supply, drinking water, recreation, clothing, dust and smoke abatement, and examination of the industrial recruit. He expressed the opinion that some form of light work should be found for the partially disabled, and made several suggestions for finding employment for the unemployed. The medical work of Messrs. Tootal Broadhurst Lee Co., Ltd., in connection with their Continuation School at Bolton, and of the Ford Motor Co., was described.

A resolution was passed to the effect that the importance of greater co-operation between all parties concerned in bringing about more healthy conditions of working, greater physical comfort, efficiency and well-being should be emphasized and that the local committee of the Industrial Welfare Society should obtain further information and suggest methods of putting into practice the co-operation desired.—L. M. S.

AMERICAN COTTON: INTERIOR OIL DAMAGE.

Attention has been drawn to complaints made by a number of cotton mills of Lancashire concerning oil damaged cotton found in the centre of the American bale (see *Cotton*, 1922, **28**, No. 1338, 2). The Manchester Cotton Association has addressed letters on this subject to the United States Department of Agriculture, Washington, and also to the various Cotton Exchanges in the South. It was pointed out that the fault is a very serious one for the mills if the oily cotton should happen to get into the machinery unobserved. A reply has been received from the United States Department of Agriculture indicating that they will gladly make every effort to remedy this evil; also various Cotton Exchanges have replied, stating that they have taken up the matter with the different ginneries. It is, however, recommended that any cotton mill experiencing this trouble should have the tags and tickets of the faulty bales kept and passed on to their broker in order that the district in which the fault occurs can be traced. —L. M. S.

THE FUTURE OF COTTON SUPPLIES.

Sir Charles W. Macara has recently urged in a communication to an American journal that the cotton spinners of the world should take a far larger interest in the welfare of the cotton growers. The communication has brought a letter of a striking character from Mr. Harvie Jordan, Secretary of the American Cotton Association. Mr. Jordan says:—"The time has come in the evolution of the cotton growing industry in this country when it has become a matter of imperative necessity that the spinners and manufacturers of the American staple take a direct interest in assisting the cotton growers in a proper economic solution of the cotton growing industry for the future. You (Sir Charles) are thoroughly correct when you assert that the average farmer can give up the production of cotton and continue to carry forward his farming operations upon a profitable basis. This, the spinners and manufacturers of cotton cannot do. As a personal illustration, I wish to state that the ravages of the cotton boll weevil were so severe on my plantation in middle Georgia last year that I have cut out the production of cotton entirely for 1922—the first time during a period of forty-five years of my farm life. The county in which my plantation is located has normally produced from 23,000 to 25,000 bales of cotton annually. Since the invasion of the boll weevil, which resulted in practically an annihilation of the cotton crop in that section last year, there will be practically no cotton planted in that county in 1922. Even over the very large area throughout the cotton belt in which cotton will be planted, the menace of the boll weevil has become very hazardous. It will be almost impossible for the farmers to produce cotton in the future under the ravages of the boll weevil, unless they are taught to intensify the culture of cotton and revolutionize the old customs and habits of production which prevailed throughout the South prior to the invasion of this insect. Necessarily, the damages of the boll weevil will increase the cost of production because the yield of lint cotton per acre has decreased not only in weight but in grade and staple. Therefore, your splendid advice to the spinners of the world is not only timely but absolutely imperative."

TEXTILE RESEARCH: FELLOWSHIPS AND SCHOLARSHIPS.

The British Research Association for the Woollen and Worsted Industries reports the award of research fellowships and advanced scholarships for the year 1922-23 as follows:—

S. W. Chester, M.Sc., of Liverpool, the sum of £200 to conduct research on wool fats at the University, Manchester; John L. Raynes, B.Sc., A.I.C., of Nottingham, the sum of £100 to conduct research on the bleaching of wool at the University College, Nottingham; George Barker, M.Sc., of Baildon, the sum of £100 to conduct research on the action of water on wool as regards strength, elasticity, lustre, dyeing properties, etc., at the University of Leeds.

Scholarships have been granted to Arthur Banks, Keighley, tenable at Bradford Technical College, and to William B. Elliot, Hawick, tenable at the South of Scotland Central Technical College, Galashiels.

REVIEWS

"GETTING THE WORLD TO WORK." By Sir Charles W. Macara, Bart (Sherratt and Hughes, Manchester; 5s. nett.)

In this work the author has brought together and presented, with necessary revision, a large number of articles which he has of late contributed to various newspapers and magazines throughout the world. The articles deal with national and international questions raised during the period of reconstruction. One question is stressed above all others—the necessity for internationalism in industry. As the author says in a foreword:—" My endeavour has been to make helpful and practical suggestions towards getting the world to work on lines of universal co-operation and goodwill." Among other subjects dealt with in this volume are:—Internationalism in Industry; Our Industrial Future; The Basis of National Prosperity; England's Industrial Policy.

THE JOURNAL OF THE
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PROCEEDINGS

Meeting at Nottingham, 18th May, 1922, Mr. W. H. Carey in the Chair.

ARTIFICIAL SILK AND ITS APPLICATIONS IN THE TEXTILE INDUSTRY.

By P. E. King, A.I.C. (Department of Colour Chemistry and Dyeing, University of Leeds).

In connection with the Annual Meeting of the Federation of Lace and Embroidery Employers' Associations, the following paper was submitted by arrangement with the Textile Institute:—

Mr. King said: I am very pleased to accept the invitation of the Textile Institute to lecture here to those interested in educational advancement. I come from Leeds University, and we are always glad to assist in any work for the benefit of the Institute. In the first place, it will be of interest to review the history of this important industry. To-day there are four varieties of artificial silk manufactured. In the order of their greatest production they are:—(1) Viscose, (2) Cuprammonium, (3) Chardonnet, (4) Acetate or Acetyl Silk. Possibly, the order of (2) and (3) may be interchanged. However, historically, I shall treat them in the order: (1) Chardonnet, (2) Cuprammonium, (3) Viscose, (4) Acetate Silk.

(1) CHARDONNET SILK.

Chardonnet or Nitro-Cellulose silk originated in a patent taken out by Count Chardonnet in the year 1884, but it was 15 years later before it achieved commercial success. One might therefore say that this industry is only 20 years old. The starting point or raw material for Chardonnet silk is cotton. This is purified and nitrated in a similar manner to that for the production of gun cotton, but the degree of nitration is less. The nitro compound in a wet state (thereby giving less anxiety on account of fire) is dissolved in a mixture of alcohol and ether, giving a highly viscous solution. After filtration under great pressure, the clear solution is forced through fine openings (between two and ten/1000ths of an inch diameter) in glass tubes to form filaments of artificial silk. The filaments, on emerging from the openings, are coagulated by the rapid evaporation of the solvent and a number are caught up to form a thread and the thread wound on to a running bobbin. The number of filaments taken up to form a thread depends on the size of the threads, the size as with all artificial and real silk being taken in deniers. The spinning apparatus is enclosed in a cover, and a current of warm, damp air passing through carries the vapours of ether and alcohol away to be condensed in amyl alcohol. Distillation of the latter re-furnishes in great part the alcohol and ether used. During drying, the fibre becomes strong, lustrous, and elastic. The silk at this stage is still nitro-cellulose, and was first marketed in this form. But owing to its inflammability, bad keeping qualities, and difficulty of dyeing, attempts were made to remove the nitro groups. This is accomplished by means of a solution of ammonium sulphide, practically all the nitrogen being removed and the resultant thread being much less inflammable and still lustrous but weaker. After bleaching, the commercial thread is obtained. I would like to point out here that the silk is regenerated cellulose or cotton, only in another physical condition. Hence it will dye similarly to cotton and mercerised cotton. This type of silk is still being manufactured at Tubize, in Belgium, about 4-5 tons per day being produced. Factories for the production of nitro silk were at one time in operation in France, Germany, Belgium, Italy, Hungary, and its production was also attempted in this country, but without success. Lehner's silk is also nitro silk and made in a similar manner, but the viscosity of the solutions was diminished by suitable additions, enabling less pressures to be used in spinning, and the filaments were spun in water.

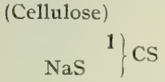
(2) CUPRAMMONIUM SILK—ALSO CALLED "GLANZSTOFF," "PAULY," "CUPRATE."

Nitro silk enjoyed great prosperity for a number of years, but had to give way gradually before its new rivals—in the first place Cuprammonium, and secondly Viscose. It was thus owing to the prosperity of the nitro silk manufacture and partly through its difficulty of manufacture that new methods were looked for, and this brings us to Cuprammonium Silk. Although here again a Frenchman took out the first patent, it was the Germans who first produced the silk on the large scale. Cotton has been, and still is, the raw material for this variety, but wood pulp is, I believe, also being used. Whichever raw product is employed, its subsequent treatment (apart from initial purification) is entirely different to the Chardonnet process. The purified cotton, preferably mercerised, is dissolved in cuprammonium solution, also called Schweitzer's reagent, which is dark blue in colour and obtained by dissolving copper hydrate in ammonia. This solution is usually prepared by passing air through a solution of ammonia containing copper turnings. The copper dissolves in about 24 hours, the temperature always being kept low. The cotton, immersed in this solution and agitated, dissolves. After filtration, the blue viscous solution of cotton is forced in a similar way to the nitro process through glass jets into a coagulating medium. This medium may be one of several, but latterly was one of caustic soda and glucose. The threads are taken up on glass reels about 6in. in diameter, and the thread traverses the length of the reel to and fro to keep them from becoming entangled. They are washed with acid to remove the copper, then in water and dried at about 50-60°C., the thread is then twisted as much as desired ($2\frac{1}{2}$-$7\frac{1}{2}$ turns). A further slight bleaching may be necessary.

A modification of the cuprammonium process was that devised by Thiele, who put up a small factory at Yarmouth to manufacture the silk. The chief difference was that he produced for the first time very fine filaments approaching real silk in size. The silk being finer closely resembled real silk, and it was less lustrous than the coarser artificial threads. His method consisted in drawing out a thick filament to a much finer one before being fully set or coagulated. The method was novel, in that the spinning solution was prepared by impregnating the cellulose with a solution of copper sulphate—precipitating copper hydrate by addition of caustic soda, filter pressing, and dissolving the mass in ammonia. The solution was also kept four weeks before spinning. This method, although producing some beautiful silk, did not achieve commercial success. Cuprammonium silk is manufactured at various places on the Continent, chiefly at Elberfield, and also in this country, and more recently the very fine filament silk has been produced. The Thiele process yields a rather dull fibre. I should like again to point out that this variety is regenerated cellulose or the original cotton in another physical form, and therefore will dye like the vegetable fibres.

(3) VISCOSE SILK.

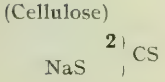
This variety was the third to achieve commercial success, and, as you are well aware, is being to-day manufactured in increasing amounts, both in this country, on the Continent, and in America. It is entirely English both as regards the chief patents and its later and successful development. The solution for the production of this silk was patented by Cross, Bevan, and Beadle—1892 to 1898. Stearn patented the first spinning process in 1890. Topham patented the centrifugal receiver since so largely used for the spinning of viscose silk, but it was not until 1905 that Messrs. Courtaulds erected a factory at Coventry for its production, and it was a few years later before they achieved lasting success. Somewhat previous to this, it had been made in Germany, France, and Belgium, but I think not so successfully as at Coventry. The raw material is wood pulp, used usually in the form of sheets called bleached sulphite wood pulp. The first operation is the conversion of the wood pulp into alkali-cellulose, and this is accomplished by steeping the sheets in a solution of caustic soda of 17—18% strength. After squeezing out the excess of alkali, the alkali-cellulose is ground into a crumb-like mass in a mill. These crumbs were originally matured in closed boxes out of contact with air and kept at a low temperature, as this method was thought to give the best results in spinning. It was, however, discovered in 1913 that oxygen was essential to this maturing process. This oxidation can be controlled and accelerated by the use of suitable oxidising agents such as sodium peroxide; also by the addition of certain catalysts in conjunction with sodium peroxide, this oxidation can be enormously accelerated. These catalysts are the salts or oxides of certain metals—nickel, iron, etc. The usual process is to steep the pulp in caustic soda containing the sodium peroxide together with the catalyst, or the wood pulp may be previously impregnated with the catalyst before immersion in the caustic soda and peroxide. Without going into the chemistry of this oxidation too much, this invention has enabled the process to be shortened and solutions of cellulose to be produced of varying viscosities so that viscose silks possessing different qualities may be obtained. The next operation is the production of the cellulose xanthate by the action of carbon bisulphide on the matured alkali-cellulose. By this reaction is formed a brown gelatinous mass which is dissolved in dilute caustic soda. This compound has the composition



$$\left.\begin{matrix}(\text{Cellulose})^{1}\\ \text{NaS}\end{matrix}\right\}\text{CS}$$

(1)

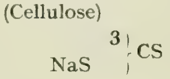
i.e., is composed of the original wood pulp, caustic alkali and CS_2 but by gradual hydrolysis (change) it breaks down, losing Carbon bisulphide and forming successively



$$\left.\begin{matrix}(\text{Cellulose})^{2}\\ \text{NaS}\end{matrix}\right\}\text{CS}$$

(2)

and



$$\left.\begin{matrix}(\text{Cellulose})^{3}\\ \text{NaS}\end{matrix}\right\}\text{CS}$$

(3)

i.e., the proportion of cellulose or wood pulp in the compound gets larger and the caustic soda and sodium smaller. The process is called ageing, and must not be carried too far, otherwise cellulose hydrate would be formed and the solution would not spin. Generally, spinning is carried out when the composition is between (2) and (3).

The solution, after thorough filtration and removal of air bubbles, is forced through jets usually consisting of platinum or some other metal and perforated with a number of fine holes. The spinning bath in which coagulation takes place usually consists of sulphuric acid, ammonium sulphate and glucose, but other baths may be used, depending on the thread required and the composition of the xanthate. The actual spinning is most usually carried out in a Topham centrifugal box. The thread after leaving the coagulating bath passes over a roller, through a vertical reciprocating tube into a circular box rapidly rotating on a vertical spindle. The centrifugal force throws the thread to the side of the box, where it builds up into an annular cake. A certain twist is also imparted to the thread by the rotation of the box. When the box is full the cake is removed and wound into skeins. The crude viscose silk is thus obtained. Subsequent purification is carried out by removing the sulphur with a bath of sodium sulphide, washing and bleaching. The production of this silk has been enormous during the last few years, and there are probably 30 factories producing it to-day.

Again, it must be mentioned that this product is a regenerated cellulose, and therefore dyes similarly to vegetable fibres, but more intensely. More recently, the production of fine filament viscose has been accomplished—the outcome of work by Bronnert. Using the same aperture for ordinary viscose, by merely altering the strength of the acid spinning bath, various sizes of filaments can be obtained down to ¾ denier per filament. The size of real silk is 1¼ denier. The same spinning speed can be preserved, *i.e.*, 40-45 metres per minute.

In this new process for fine spinning, it is important to maintain a maximum concentration of acid for each count. Brilliancy in the fine counts might be varied at will and without any damage to the strength of them. To get an opaque thread, reduce the temperature. By raising the temperature to 80-50°C., a thread of more and more brilliancy can be produced.

(4) ACETATE SILK.

We now come to the most recent of artificial silks, that termed Acetate or Acetyl Silk. This, as you are aware, is coming on to the market and is creating a great amount of interest. Acetate silk differs from the other three varieties in this important respect: the silk as sold is not regenerated cellulose, or the original raw material in a different physical form, but cotton or cellulose containing the acetic acid groups in combination with it; or, to put it another way, it is the same chemically as that dissolved in the solvent for spinning. For some years before 1914, attempts had been made on the continent to exploit this process, but without lasting success. During the war, the manufacture of cellulose acetate was carried out in this country, but this was used as a dope for aeroplanes. Since then, the cellulose acetate has been successfully used for the production of artificial silk. Cotton or wood pulp forms the starting point or raw material. This, after purification, is converted into a compound containing acetic acid or what is chemically termed an acetyl compound of cellulose. One may compare this compound with the similar nitro-cellulose, except that acetic acid replaces the nitric acid. This derivative is dissolved in acetone and the solution filtered. The viscous solution is then forced through fine openings in a metal cap, the issuing filaments are coagulated by a current of warm air, and the solvent recovered as far as possible. The filaments are then brought together to form a thread, to which is then given the requisite twist.

Subsequent treatment is similar to that for other silks. It is interesting to note that the composition of this silk corresponds chemically to approximately the di-acetyl derivative, *i.e.*, the treatment with the acetylating agent is not carried to its ultimate stage, the tri-acetyl compound. On account of this fact, the silk is more easy to wet out with water than the tri-acetate would be.

THE DYEING OF ARTIFICIAL SILK.

As I have previously pointed out, Chardonnet, Cuprammonium and Viscose silks are all regenerated cellulose or at least cellulose combined with water. They are thus similar chemically to mercerised cotton, and the dyestuffs and dyeing methods which are used for the dyeing of these three types of artificial silk are the same as used for cotton. However, these three types do differ somewhat from each other in the degree of dyeing. Chardonnet silk, owing to residual traces of some sulphur compounds, can be dyed with basic colours without a mordant. Even for full shades, mordanting with tannic acid and tartar emetic is in most cases unnecessary if no special degree of fastness is required. If the shades require to be faster to water, washing, and cross dyeing, mordanting is essential.

Direct dyestuffs have less affinity for Chardonnet silk than either Cuprammonium or Viscose silks. In its dyeing properties, Cuprammonium silk closely resembles mercerised cotton, and the direct cotton dyes are generally the most suitable: with basic colours a previous mordanting is essential even for light shades. Viscose silk is very similar to Cuprammonium as regards dyeing, but basic colours dye Viscose deeper than Cuprammonium silk, though not so strongly as Chardonnet. With Viscose, light and medium shades may be dyed without a mordant, but deep and fast shades require a preliminary mordant. Sulphur and vat colours can be used for the production of fast shades on all these products.

Thus, you will see that these three varieties can be woven along with pure silk, cotton, or wool, and the resultant pieces dyed in the piece—looking upon the artificial silk from a dyeing point of view as mercerised cotton and adopting precautions necessary for the artificial silk taking colour more strongly. By this, I do not mean that you can use either silk at will and expect to get level results more than you would by using different qualities of wool in the same piece. Neither do you always get level results when using the same artificial silk: it is important to keep different batches apart as far as possible.

Coming now to acetate silk, we have a fibre differing chemically from the three just mentioned and therefore differing in its dyeing properties. To just go back to its manufacture, acetic acid is attached to or chemically combined with the cotton or wood pulp used, or, to give it its chemical name, cellulose. The point I wish to lay stress upon is that contrary to nitro or Chardonnet silk, where the process of denitration removes the nitro groups or the nitric acid part of the compound, with acetate silk this is not done and the commercial thread contains acetic acid in its composition. We have therefore a similar thread to the original Chardonnet (in which the nitro groups were not removed) in that acetate silk will not directly dye with direct cotton colours, or that the affinity between dye and fibre is very slight. The same remark applies to dyeing with the sulphide colours and also vat colours.

However, if the acetic acid is partly removed by a suitable treatment, dyeing will take place with these groups of dyes. This method of dyeing is called the " saponification " method. It consists in treating the silk in a hot bath with a specified quantity of caustic soda to remove an equivalent amount of acetic acid so that the silk approaches more nearly to its original condition, that is, cellulose. The degree of dyeing should be proportional to the amount of caustic soda used. This method does not always produce even results: to be perfect the amount of saponification must be equal throughout the surface of the filament. This is not always easy to control, so that unequal saponification takes place, more in one place than another, with consequent uneven dyeing. Complete saponification, *i.e.*, a regeneration to cellulose, is not desirable, on account of the loss of lustre sustained and also loss of silk-like properties, also loss of weight. The process may be carried out in two ways, either by the one-bath method in which the alkali and dye are in the bath together so that dyeing proceeds simultaneously with saponification, or the saponification may be carried out first and the dyeing operation then conducted subsequently in a similar manner to other silks. By this saponification method, the direct cotton, basic, sulphur, and vat dyestuffs may be applied. The one bath method is not to be recommended. The temperature at which these operations are carried out is of very great importance: whether in saponification or dyeing a temperature of 75°C. is the maximum that should be employed. A recent patent says that caustic soda saturated with common salt gave a more even result.

We will now proceed to the dyeing with those dyestuffs which have a direct affinity for acetate silk, and of these the basic group of dyestuffs stand out most prominently. Taking the animal fibres into consideration for one moment, we know that wool and silk possess both what are called acid and basic properties or are capable of functioning as an acid or basic substance. Hence, both wool and silk will dye with both acid and basic dyestuffs without any preliminary treatment, that is, because with basic dyes both fibres act in their acid capacity and with acid dyes in their basic capacity. Now taking cotton, the chief representative of vegetable fibres, and with this we can of course associate wood pulp. In this case we have a fibre with no pronounced acid or basic properties, and with the absence of these is explained its non-dyeing property with either acid or basic dyes. But cotton can be dyed with basic colours by giving it acid properties, and this is accomplished by mordanting it with tannic acid, after which the dyeing with basic dyes is easily carried out.

Now you will see the reason why acetate silk will dye directly with basic colours: it is owing to the retention of the acetic acid combined with the cellulose or cotton that confers acid properties on the fibre, and hence dyeing with these colours takes place without mordanting. A very remarkable phenomenon here occurs. The basic colours as a class are extremely fugitive to light, but some dyed on acetate silk are extremely fast: Malachite Green on acetate silk is very fast to light, but extremely fugitive on tannined cotton or wool. Others are similarly fast to light, but also a number are no faster on this silk than on cotton, and in one case the reverse is the case—Methylene Blue is fairly good to light on cotton and wool but fugitive on acetate silk. There are some other dyes strictly belonging to the mordant class which have, however, a good affinity for acetate silk. This is due to the basic properties of the dyestuffs: these are termed Gallocyanine dyestuffs. Also a few acid colours are capable of dyeing very good shades, but these are of a less pronounced acid character. In fact, ordinary acid colours containing sulphuric acid in any quantity in their composition will not dye acetate silk.

Lastly, we have dyeing acetate silk by the "development" process. Reverting for one moment to the similar method for dyeing cotton: in this case cotton is actually dyed by colours which, however, owing to their chemical constitution, are capable of reacting with nitrous acid on the fibre (called the diazotisation process) and then these new compounds coupling with organic compounds, such as naphthol, diamines, etc., to form in reality new dyes much faster to washing, etc., than the original colour. Primuline is, of course, the well-known example of this class.

Acetate silk absorbs very freely substances such as amines, phenols, etc., and, with the amines, a similar procedure can be carried out as I have just mentioned, *i.e.*, diazotising the amine and the formation of a colour by its coupling with other phenols, amines, etc. The difference is that with cotton the first compounds put on are already dyestuffs and can be used in many cases without after treatment; but with acetate silk the preliminary amines, etc., are mostly colourless, and colours are only developed by coupling the body.

This process, although of course somewhat long, is capable of producing very fine shades—fast to light and washing. Care has to be taken with deep shades to avoid loss of lustre, and, further, with deep shades, rubbing is liable to occur.

GENERAL PROPERTIES OF ARTIFICIAL SILKS.

As regards lustre, they are all more lustrous than real silk, Acetate being somewhat of a quieter lustre. Cuprammonium generally possesses a hard, glass-like lustre, and this is useful where strong effects are desired, as in laces, edgings, etc. The smooth rounded section of its filaments made it good for braiding or knitting. When spun in fine filament, the lustre is duller. Chardonnet and Acetate sometimes show (what is said to be a defect) glittering points or specks. Viscose silk is very lustrous. Acetate silk is a non-conductor of electricity and also of heat, and it feels somewhat warmer to the touch than the other silks.

It has been stated by Wilson that, with viscose silk, by alteration of the composition of spinning bath and of the spinning liquid, fibres of varying shapes of cross section and thus of different lustre, covering power, dyeing affinity, etc., can be made. Its fibres may be either smooth and round or irregular and serrated in cross section or with other variations. He stated that the other silks do not possess this property, but have generally a smooth outline, with consequently less lustre and covering power. These statements have been lately verified by Bronnert, who has by variation of the baths produced many types of viscose silk which are particularly adapted either for braiding, weaving, or knitting.

VOTE OF THANKS.

Mr. TUNNICLIFFE moved that the best of thanks be given to Mr. King and to the Textile Institute for making arrangements for the lecture, which, he remarked, had been one of supreme interest.

Mr. LITCHFIELD seconded the resolution, and in doing so said the lecture on this occasion had met the requirements of the manufacturing end of the trade in regard to the simple and informative way in which Mr. King had dealt with the four main varieties of artificial silk and their different constituents and qualities. One was often asked what artificial silk was in view of the difficulties that dressers and finishers experienced in dealing with it, and a good deal of clear and valuable information had been afforded by Mr. King to the machine end of the trade. (Hear, hear.)

The resolution was heartily carried.

Mr. KING, in acknowledging it, said it had been a great pleasure to prepare the lecture. He wished to acknowledge the kindness of the following firms for the various samples, which he was able to offer for inspection, of artificial silks and materials containing artificial silk:—Messrs. Courtaulds, Ltd., British Cellulose and

Chemical Manufacturing Co., Ltd., British Dyestuffs Corporation, Ltd., Mr. W. Harrison (Burgess, Ledward and Co., Ltd.), Messrs. Clavel and Lindenmeyer, The Kent Silk Mills, Ltd., and Messrs. Brotherton and Co., Ltd.

SOUTH OF SCOTLAND SECTION

Meeting at Technical College, Galashiels, 17*th March,* 1922, *Mr. J. Hutcheson in the Chair.*

BALL AND ROLLER BEARINGS AND THEIR APPLICATION TO TEXTILE MACHINERY.

By M. J. S. Cooper, B.Sc.

In his opening remarks, the lecturer outlined the development of modern anti-friction bearings, and, having quoted instances in which such were running successfully under arduous conditions, suggested that textile machinery afforded a wide field for their application, whereby considerable improvement could be obtained, not only in the mechanical efficiency of the machines, but also in the results of the various processes concerned.

Several types of bearings were exhibited, including rigid and self-aligning ball and roller journal bearings designed to carry journal or radial loads, and also single and double ball thrust bearings, to carry end or axial loads in either one or two opposite directions. The functioning and construction of these were explained with the help of lantern slides. Attention was also drawn to the importance of correct mounting, and adequate protection of the bearings at all times from dirt and moisture, in order to ensure success.

The advantages to be derived from the use of these bearings as applied to textile machines were enumerated as follows :—

1.—Power saving and economy of lubricant.
2.—Low starting effort.
3.—Free and smooth running.
4.—Elimination of heating and seizure.
5.—Elimination of wear.
6.—Ease of lubrication.
7.—Elimination of oil throwing, and cleanliness.
8.—Easy attainment of high speeds.
9.—Compactness.
10.—Reliability.

Referring to tests carried out by the National Physical Laboratory, and comparing the coefficient of friction of a ball bearing with that of a plain bearing, using needle or oil ring lubrication, it was shown that the former effect a saving of 90% of the power usually absorbed by the latter when running. Further tests proved that the reduction in starting effort was in the neighbourhood of 1,000 :1, which could not fail to be appreciated. These laboratory tests were substantiated by results obtained in actual practice, and in the case of a set of waste-breaking machines, equipped with anti-friction bearings, the economy in power amounted to 23% of their previous consumption.

Examples of other advantages claimed were given, and illustrations of several applications of ball and roller bearings to various textile machines were shown. These slides included sectional drawings and general views of many well known machines which have been running successfully for long working periods on anti-friction bearings.

At the conclusion of the lecture, questions were invited, and an interesting discussion followed.

On the motion of the Chairman, a very hearty vote of thanks was given to Mr. Cooper, and indebtedness to the Hoffman Manufacturing Co., Ltd., Chelmsford, was expressed in respect of the availability of exhibits.

NOTES AND NOTICES

DEATH OF MR. W. M. JACKSON.

It is with extreme regret that we have to record the death of Mr. William Morton Jackson, manager of the firm of Messrs. John Harwood & Son, Ltd., cotton spinners, of Bolton, which took place at his residence at St. Annes-on-Sea on the 11th September. Although he had occupied the position named for a few years past, Mr. Jackson was perhaps best known as the former manager of the Bradford Conditioning House. He was one of the earliest members of the Institute, was a member of the Council, and from time to time had actively served upon many important committees, and his attitude was always one of sincere desire to give helpful service.

THE INSTITUTE'S AUTUMN CONFERENCE.

As briefly announced in our previous issue, the Autumn Conference this year is to take place at Blackburn. In response to a suggestion sent in by two or three members in the Yorkshire area, however, the initial part of the proceedings will take place at Manchester, in order that the opportunity may be taken of visiting the Exhibition of Textile Machinery and Accessories. A preliminary announcement has already been issued to Institute members, but the fact may be here recorded that the visit to the Exhibition is fixed to take place on the 12th October, whilst the Conference proceedings will follow on the subsequent day at Blackburn, beginning at 11-15 a.m., in order to give the widest margin for facility of attendance involving journeys by train. Mr. C. F. Cross, B.Sc., F.R.S., of London, has accepted the invitation of the Council to deliver the Annual Mather Lecture at Blackburn on the date named, Friday, the 13th October, when he will deal with the subject of Artificial Filaments—a subject upon which he is recognised as a leading authority. In the afternoon of the same day, a visit will be made to the interesting works of the British Northrop Loom Co., Ltd., at Daisyfield, Blackburn. The Institute's proposal to hold the Conference at Blackburn was warmly received on the part of the Blackburn and District Cotton Employers' Association, who have invited visiting members to luncheon following the delivery of the Mather Lecture. Altogether, the programme promises to be one of a highly attractive character.

FAULTS IN TEXTILE FABRICS.

At the time of the Annual General Meeting of the Institute in the Spring of the present year, uncommon interest was evinced in the collection of fabrics containing faults from the standpoint of the finisher—specimens which had been brought together by Messrs. S. H. Higgins and A. Hodge, of the Bleachers' Association and Calico Printers' Association, respectively, and which were referred to in a paper then submitted. The effort represented the beginning of something in the nature of a campaign having for its object the curtailment, if not the elimination, of faults exposed. During the coming lecture period of the Institute and of the various textile societies, Messrs. Higgins and Hodge have arranged to visit several centres in the Lancashire area to exhibit the specimen fabrics, to refer to them in detail, and, doubtless, to answer questions which may be raised on the part of those specially interested. In several cases meetings have already been arranged, so that a number of organisations may be collectively appealed to in a given area, the Lancashire Section of the Institute and textile societies in the different districts co-operating in the arrangement of the fixtures. It is interesting to note that the Yorkshire Section Committee of the Institute is taking steps to bring about a full consideration of the whole matter of faults in fabrics, and a number of organisations have been invited to appoint representatives on a committee or panel with a view to discussion as to the best means of approach to consideration of the whole subject.

TRADE REGARDED AS "PICKING UP."

It is hardly to be doubted that things in the industrial world are picking up; we are far from being at the end of our troubles, and there will be no clear course to prosperity and normal times until the European situation is nearer a settlement, but the revival is beginning. On the Yorkshire side, there has been, perhaps, more progress; Lancashire has been upset by the reports concerning the cotton crop. But, even here, all is not bad, and the outlook is not gloomy. Pretty obviously, the time is drawing nearer when we shall be less dependent on America for our supplies of raw material, and the thing to do now, whilst conditions are not at the best, is to put our backs into this business of developing fields elsewhere for the production of the cotton at an economical and marketable figure. Employment in the sheds and mills is better, even taking into consideration that Lancashire has been and is still on holiday—and not even bad times can prevent the Lancashire operative from having a good holiday. A lighter pocket than usual may serve to restrict his travels, but, whether at home or away, a holiday he has. On the whole, too, he is optimistic, and it would do no harm if some of this spirit of his penetrated more deeply into other circles. We need more optimism, more confidence and less of Government interference. Given these, and especially the last, and the cotton trade would soon give evidence of its vitality and its faculty for recovering from difficult times. —R. C.

GENERAL ITEMS AND REPORTS

WOVEN COTTON FABRICS.

The Cotton Industry Sub-Committee of the Lancashire Education Committee (Higher Education) at a meeting held at the Textile Institute, Manchester, last month, made recommendations as to the awarding of scholarships and prizes offered for competition.

The Sub-Committee received the report of the examiners (The Crompton Prize Fund Committee of the Textile Institute) with respect to the award of prizes for collections of woven cotton fabrics, the report reading as follows:—

To the Cotton Industry Sub-Committee,
Lancashire Education Committee,
County Offices, Preston.

GENTLEMEN,

A Committee of the Textile Institute has adjudicated upon the albums submitted in connection with the above-named competition and recommends awards in the subjoined order:—

£10 and Gold Medal	Album No. 355
£10 and Silver Medal	Album No. 347
£10 each to	Albums 357 and 351
£5 each to	Albums 352, 354, 346, 349 and 353

The Adjudicating Committee, comprising members from various parts of the county, desire to state that the awards recommended were arrived at after exhaustive examination, both individually and collectively. Absolute unanimity prevailed as to the premier awards. The first prize winning album was of outstanding merit from all points of view, and the adjudicators have pleasure in recording their appreciation of the all-round high quality of the work of the competitor in question. It is satisfactory to note that in the case of the leading awards competitors have maintained a keen appreciation of commercial requirements. In many other cases, however, over-reaching in effort to secure novelty resulted in failure from the commercial standpoint.

The Committee found it desirable to recommend the withholding of one of the £10 awards the principle being adopted of requiring minimum percentages of full marks for the respective grades of awards.

The adjudicating committee have again to emphasise the undesirability of excessive employment of expensive yarns. In the matter of colour, the suggestion may be made that greater courage should be exercised by competitors generally timidity in the use of bright colours being far too frequently in evidence.

In the mounting of the patterns, considerable improvement is recordable, though two or three of the competitors, by passing down the entire pattern, failed to allow for facility of inspection. Students would be well-advised to give greater consideration to their descriptions of fabrics, many of the descriptions given offering no real indication of the purpose for which the fabric might be intended. More attention should be given to costing particulars.

Collectively, the albums form a really satisfactory result of the competition, and the adjudicating committee hope to witness an increase of competitors in future years.

(Signed),
For the Committee,
J. D. ATHEY,
General Secretary.

16, *St. Mary's Parsonage,*
Manchester,
1st July, 1922.

After considering the report, the Sub-Committee recommended that a gold medal together with a prize of £10, be awarded to J. C. Woodhead, Nelson; silver medal, with prize of £10, to Harold Kay, Darwen; prizes of £10 each to J. M. Yerkess and Herbert Arnold, Nelson; and that prizes of £5 each be awarded to Arthur Arnold, Nelson; and that prizes of £5 each be awarded to Arthur Bailey (Nelson), George Leeper (Nelson), Alan S. Sanders (Darwen), Harold Hall (Rishton), and J. W. Eastwood (Briercliffe).

It was also decided that the existing scheme of prizes for collections of woven cotton fabrics be continued without alteration for the year 1923, and that the arrangement with the Textile Institute, Manchester, for the conduct of the examination, and the provision of samples of fabrics for use at twenty approved schools in the County area where cotton classes are carried on, be renewed.

It was recommended that Cotton Weaving Scholarships of the annual value of £60, plus fees, be awarded to Leo. Swarbrick (Nelson), James M. Yerkess (Nelson), and George A. Armett (Worsley).

COTTON GROWING FACILITIES IN THE SUDAN.

The Earl of Balfour received at the Foreign Office recently an important deputation, representing the Empire Cotton Growing Corporation and other bodies interested in the textile industries of Great Britain. Their object was to impress on His Majesty's Government the great importance which they attached to the early completion of the Blue Nile dam and Gezira irrigation scheme in the Sudan. The Rt. Hon. H. H. Asquith (Paisley) introduced the deputation, and the views which they wished to impress upon the Secretary of State were explained by Lord Derby and Mr. Clynes, while Mr. Jackson and Colonel Birtwistle spoke in support, emphasising the seriousness of the situation with which the cotton industry was threatened owing to the danger of a shortage of raw material within the next year or two and the need for developing as fully as possible the resources of those parts of the Empire in which cotton is or can be grown.

In replying to the deputation, Lord Balfour was able to assure them that the object which they had chiefly at heart was already secured and that the temporary difficulties of the Sudan Government, which had necessitated a momentary suspension of the work on the lower Blue Nile dam, had now been surmounted. Work would, therefore, be resumed this autumn as soon as the fall in the flood made active operations possible. No opportunity was lost of pursuing investigations on the upper reaches of the Blue Nile with a view to obtaining reliable data on which to base projects for the construction of a great reservoir, which it was hoped would eventually serve the double object of permitting the further development of cotton cultivation on a large scale in the Sudan, whilst, at the same time, supplying a greatly increased water supply to Egypt.

In conclusion, Lord Balfour expressed himself satisfied that the work on the lower Blue Nile dam would be resumed in conditions more satisfactory than those which had hitherto obtained, and that there was every reason to hope that it would be completed with the least possible delay.

In thanking Lord Balfour for having received the deputation and for the very satisfactory and reassuring statement which he had just made, Lord Emmot took occasion to emphasise the great importance to British trade of the assurance that the prosperity of both Egypt and the Sudan should not be menaced by any failure in their water supply.

MECHANICAL FLAX-PULLING TESTS.

To-day hand pulling of flax is not only relatively costly, but the process is slow and skilled workers are few and not easily available. For centuries it was thought impossible that grain could ever be harvested by machinery. Of course, the reaper is useless for flax, since it must be pulled up by the roots in order to preserve, not alone the full length of the fibres, but also its spinning qualities.

Flax pulling by mechanical means has engrossed human ingenuity for many years, and now something like success has been achieved. Recently (says the *Belfast Telegraph*, 26/8/22), under the auspices of the Northern Parliament of Ireland, a practical demonstration of mechanical pulling of flax was given in a ten-acre field near to Belfast. Three machines, all differing in principle and details, were introduced to the observation of a large number of interested and critical spectators. Each type of machine gave satisfactory manifestation of its ability not only to pull the flax, but when necessary to deliver each " beet " neatly tied with string, for convenience of future handling.

The machines which entered the field were:—(1) The York Street Flax Spinning Mill, Belfast, invented by Mr. J. G. Crawford, Belfast, and R. M. Bennett, Carryduff, Co. Down; (2) The Canadian Vessot Puller; and (3) the mechanical puller of the Fibre Corporation, Dromara, manufactured by Messrs. Marshall, Sons, and Co., Gainsborough.

Altogether it was concluded from the display and actual pulling results that the flax pullers have been evolved for practical use. Modification and perfecting of details of mechanism, a reduction in cost of production and adaptability for horse or motor power, together with a machine of such dimensions that it can enter an average gateway and suit the size of Irish fields, are the only preludes now to their general adoption. —F. B.

ORGANISING THE COTTON TRADE.

Presiding at a meeting of the Manchester and District Cotton Employers' Association at Manchester, on the 1st September, Sir Charles Macara said he was glad that the General Committee of the Federation of Master Cotton Spinners' Associations had taken up in earnest the movement to place the cotton trade on an organised basis, and expressed approval of the suggested plan of endeavouring to divide the trade into sub-sections and regulate supplies according to demand. The managing of the trade as a whole had been so successful in the past in dealing with the vicissitudes that were inevitable in such an industry as that of cotton, that it was difficult to understand why the method should ever have been allowed to fall into abeyance. If industries were run as industries, there would, he believed, have been a great reduction in the losses the trade had had to suffer recently, and he hoped the General Committee of the Federation would be eminently successful in the action they were taking to regulate production according to demand.

Amplifying this statement, Sir Charles, in a communication issued to the Press, states that two things will have to be done to put matters on a footing to prevent a continuance of losses. The Cotton Control will have to be revived, and the trade will have to be sectionalised in order to facilitate organisation. He is of opinion that it would not take long to put the whole trade on a satisfactory basis if all pulled together. A situation in which the weakest sellers control the markets, and keep the industry as a whole making serious losses, cannot be tolerated.

THE MAMMOTH LOOM.

Some few months ago, reference was made in these columns to the production in America of a loom of exceptionally large dimensions. Messrs. Robert Hall & Sons, Bury, Ltd., now send us particulars of a loom of great size, the production of which has just been completed at their works at Bury. The loom is described in detail as follows:—" The loom is 36ft. 2in. long over all by 7ft. 6in. wide over all, the reedspace being 28ft. It is of massive construction, the slay being actuated by a cam instead of the usual crank. This enables the dwell of the slay to be exactly as desired. The driving is double-geared with a slip wheel for preventing breakages. The picking is by side lever and quadrant. The treading is outside, consisting of whole plate tappets, and the jacks or heald levers are quadruple. The taking-up is by means of worm and wheel at each end. Generally, the loom is very well stayed and made strong in every particular. The yarn beams and the taking-up roller are well stayed and strongly built up to fulfil their purposes."

SCIENTIFIC AND INDUSTRIAL RESEARCH IN CANADA.

According to the Report of the Honorary Advisory Council for Scientific and Industrial Research of Canada for the year ending March 31st, 1921, a research is in progress on the milkweed, which is very common throughout Eastern Canada, with a view to determining its availability as a substitute for flax. The utilization of the flax straw of the Prairie Provinces is also receiving considerable attention. —L. M. S.

HEALTH IN THE FACTORY: THE BOURNVILLE SCHEME.

In response to numerous enquiries from individuals, firms and various journals, Messrs. Cadbury have published a small pamphlet describing the measures adopted at Bournville for ensuring, as far as possible, the health of the workers and for the care of them during sickness. The following are the main points in the scheme:—The working week is 44 hours. The works environment and the design and lay-out of buildings are such as to ensure happy working conditions. Dressing, retiring and dining rooms are provided, and an organised kitchen service. Encouragement is given to athletics and facilities afforded for physical culture, pursuit of the fine arts, and various hobbies. All the foregoing, it is asserted, are fundamental to the proper working of the scheme. The pamphlet then goes on to describe, with statistical records, the work and scope of the Medical and Dental Departments at Bournville, and gives details of a sick benefit scheme and benevolent fund. The Medical Department employs two full-time doctors and a staff of trained nurses, and the Dental Department three whole-time professional dentists, two mechanics and four attendants. And besides possessing convalescent homes in Herefordshire and North Wales, the Medical Department is in liaison with various public health institutions, specialists and makers of surgical appliances, and carries out propaganda work in connection with the Bournville Educational Scheme. The number of employees is 5,148 men and boys, and 4,275 women and girls.

The whole scheme as described in the pamphlet bears all the marks of a policy that has been persistently followed for a long period; it is comprehensive and intensely organised, and leaves one with the impression that in an industry where such is possible the economic forces at work must be simple, readily measured and within the grasp of a single mind. —W. N.

IRISH FLAX CROP: THE CONTINENTAL HARVEST.

To great linen centres like Belfast and to the many engaged in the utilisation of flax, the development of the Irish flax industry is a matter of the deepest interest. The prospects of a good yield for Irish growers (says *The Belfast News Letter*, 12/9/22) are more promising than in any recent year, although the acreage (not yet officially declared) is known to be 30—40% less than in 1921; but last year there was a very large carry over of non-scutched flax straw from 1920.

The prices now paid for Irish flax are about 12 shillings for the lower sorts and approximately 22 shillings for the finer sorts, per stone. At these figures, a fair yield should provide a good margin of profit, and, in fact, many farmers are now regretting that they did not include flax among their other crops.

A plentiful supply of continental fibre is always an important consideration in the prosperity of the Irish linen trade. In Belgium, this year, the acreage under flax is said to be greater than last year. In France and Holland the reverse is thought to be the case. About half of the flax crop for 1922 is expected to be inferior in quality and shorter in yield than for 1921, but the remaining half promises to be of medium length and of good colour and strength, though not quite up to the average yield of last year.

During this year considerable business has been transacted in Russian (Baltic Provinces) flaxes—at first confined to sales on the continent, but in the last three or four months a few thousand tons have been absorbed by the Irish spinners at prices ranging from £85 to £105 per ton. Regular sailings have now been resumed by the Head Line of steamers between Belfast and the Baltic ports of Riga and Reval. Future developments are uncertain, but it is reported that the new Baltic states of Latvia, Esthonia, and Lithuania have been giving increased attention to cultivation, and that increased sowings have been made this year. Of Soviet Russia's available supplies nothing positive can be said. A probable crop of 20—25% of a normal pre-war year is all that can be safely assumed after collecting all possible figures. —F. B.

REVIEWS

LINEN. By A. S. Moore. Edited by Gordon D. Knox. (Constable & Co., Ltd., 10s. 6d. net.)

There are few more fascinating studies in economic history than tracing the origin, evolution, and development of any textile industry, and the three leading and interesting chapters in this treatise on "The Antiquity of Linen," "English and Scotch Linens," and "How Ireland took the lead," fully justify this assertion.

Beginning with the antiquity of linen, the author deduces that linen was fairly extensively used in the antediluvian days, because the inhabitants then dwelt chiefly in tents, and linen was the most suitable material known to the ancients for tent-making. Many illustrative examples are supplied to assist in proving this deduction.

The evidences given of the early and subsequent uses of linen are many, and are interestingly recorded. The Egyptians were the chief people who spun flax and wove and embroidered fine linens; but the Phœnicians were the most important nation in fostering the Egyptian trade in linens. The Phœnicians, who possessed remarkable energy, alike in maritime, mercantile, and manufacturing pursuits, early discovered the use of strong linen cloth for sails, and of flax cordage for riggings for their ships. With the subsequent decay of Egypt, the manufacture of linen also waned, while other countries, given a greater freedom, induced and encouraged the linen manufacture to take up a new abode—first in Italy and the mighty Roman Empire, until, finally, the loss of Rome offered Western Europe and the British Isles a gain in this direction. Here, the linen industry found its most congenial soil, and the author, in an interesting and instructive chapter, seeks to emphasise that as "Westward the course of Empire takes its way" so did the linens of Egypt, first brought by the Phœnicians into England, finally settle in the British Isles.

The later influx of Belgian colonists into these Islands, about a century before the Roman Invasion, was also a means of reviving, encouraging, and developing the linen industry. It was not, however, until the large influx of Flemish emigrants, driven from their homes by the persecutions of the Duke D'Alva, landed in England, and were encouraged to continue their industrial pursuits, that Britain began to take a premier position as a manufacturer of linens and textiles generally. Many interesting abstracts and quotations are systematically recorded in support of these important data.

The author next discusses the efforts and enactments—almost legion—which were made to induce and enforce the growing of flax and the production of linen in England and Scotland, and he concludes that fate indeed, from first to last, seems to have been unkind towards every endeavour to manufacture linen, especially in England, until finally the English naturally asked the question, "Is it really worth while to grow flax and produce linen?"

In describing how "Ireland took the lead," the author briefly enumerates the primitive and evolutionary methods employed for spinning and weaving flax in Ireland.

A considerable number of pages are next devoted to formulated Acts of Parliament, Grants, and the Establishment of the Linen Board, and to the advent of the Huguenots who fled from France into Ireland on the Revocation of the Edict of Nantes.

In his chapter on the linen trade " as it is," the author dilates on the world-wide popularity of linen compared with the limited area in which it is produced and centred chiefly in North-East Ulster, with Belfast, the commercial capital of Ireland, in its midst, and from which city immeasurably the greatest bulk of fine flax yarns and linens of all descriptions are exported to every port of the civilised world.

The ever-present problems of the supply of flax and of flax in the field are satisfactorily considered from the point of view from which the book treats.

The chapters from Sale to Spinner, the Spinning Mill and the Weaving Factory are informative in general character and portrayed in a manner which will be appreciated by the general reader. The two remaining chapters of operative processes, " Fine art in linen " and " Bleaching and finishing," are likewise instructive and well written. The author deals with this division under the heading, " The Wonderful Warehouse," and the examination of linens, measuring, and the distinctive methods of marking, etc., are described so picturesquely that they will be read with novel-like interest. But, he says, the unitiated must actually visit the warehouse to see linens, handsome and attractive, ready for placing in their suitable packages before export.

The titles of the last three chapters are:—The Marketing of Linen, Linen Trade Organisations, and the Future of the Linen Trade. In these the author gives a good idea of the ramification and world-wide interest of the linen industry, concluding with a few ideas on the prospective future of the trade.

The book contains 15 chapters, 17 half-tone illustrations, and over 200 pages, is indexed, well printed, and handsomely bound. —F. B.

SHARING PROFITS WITH EMPLOYEES. James A. Bowie, M.A., Lecturer in Economics at College of Technology, Manchester. Sir Isaac Pitman & Sons, Ltd., London; 10/6 nett.

The appearance of this book is certainly opportune; in fact, it shares this with all the volumes in the series, because no two subjects excite more controversy at the present time than the sharing between employers and employees of the profits of industry and the methods whereby these profits arise. The writer evidently has his subject at heart, and is anxious to point the way to some means whereby a solution may be found for the problem which is at the root of modern industrial troubles. Apart from the relation of various schemes of profit-sharing to industrial efficiency, social problems, and equitable distribution of wealth, the author definitely asserts that the mere sharing of cash profits between employer and employee is quite ineffective, but the right solution is one of principle, involving real community of ownership, control, and interest. Judged by history, results, and the consideration of practice and theory, Contributory Partnership appears to the author to be the truest solution.

The volume is divided into four parts : Part 1 discusses the profits, viewed in turn from the point of view of Labour, the Employer, and Impartial Observer. The principles underlying production, and the relative shares in distribution secured by the factors of production, are reviewed, together with the alternative methods of developing production without the incentive of profits. Parts 2 and 3 deal respectively with the nature and methods of profits-sharing as contrasted with those of co-partnership. In Part 4, various schemes of considerably different nature are surveyed critically, whereby endeavour is made to give the employee some share in the prosperity of his employer. The above main sections of the volume contain much evidence that is very carefully sifted and weighed, and, in certain details, merits close examination by all those interested in industrial administration or social problems—whether the motive be increased efficiency, altruistic, or purely selfish. Our author states the general labour view to be that mal-distribution of profits is not merely an immoral feature of the wage system, but, also, that the attempt to share profits in the form of increased wages is a futile pursuit if only through the relation of wages to prices.

We should have preferred that the factor vaguely summed up as " Labour," had been defined more closely before the attempt to express its attitude to " profits." Labour is certainly not a homogeneous entity, and its attitude to profits is by no means a single "mass mind," as the author seems to assume. The attitude of the working-men directors to their wage-earning employees is a useful index. The employer's view of profits is briefly summed up as "the inducement to produce," whereby interference with business incentive and the motive of production destroys the latter. The author has little sympathy with the proposals that the State would undertake production.

The conflict between the view of the employer and that of the employee is, briefly, that the former desires to conserve his autonomy and the latter to share control and profits. How are wages and dividends to be yoked? Also might we ask, how are wages and losses to be correlated? Chapters 4 and 5 discuss the fundamentals underlying production and the play of economic forces in the capitalistic system; a shrewd review is made of the control of production by the Public Authorities, and the possibilities of taxation as a social instrument, especially for the purposes for a more equitable distribution of profits. The argument reviews the alternative methods whereby production is carried on without the intervention of profits as in a capitalistic system, *e.g.*, the Co-operative Movement, Municipalisation, Nationalisation. Co-operative methods have proved unsatisfactory for industry on the "great scale," and especially for production, and industrial enterprise suffers from the defects of bureaucracy. Chapter 5 discusses the various methods of remunerating labour, and, in particular, the much belauded system of payment by results; given satisfactory methods of fixing rates, &c., the latter recommends itself as a partial solution of the problem of equitable remuneration, but not of the central problem of a more equitable system of industry.

Part 2 discusses the general nature of Profit-Sharing, especially the difference between sharing "according to profits" and sharing "out of profits." The history of the idea is traced from the early schemes of Turgot and Owenites, but Leclaire is credited with the parentage of the idea. The diversity of aims is illustrated—for example, the purely altruistic schemes of Wm. Thompson & Sons, Ltd., or that of J. T. & J. Taylor, Ltd., the anti-trade-union schemes, others designed to increase efficiency and smooth working. The definite schemes of profit-sharing are reviewed and compared, especially in Chapters 7 and 8, where a close analysis is made of particular schemes according to (1) the agreement between the employer and employee; (2) the determination of the divisible profit; (3) the sharing of divisible profit between shareholders and employees; and (4) the considerations under which employees participate.

In the opinion of the reviewer, Chapters 8, 9 and 10, dealing with profit-sharing from a practical standpoint, form an admirable guide or rather warning for any business man contemplating profit-sharing. We believe it would lead him to prefer the considerations of co-partnership, especially as exemplified in the particular schemes of Chapter 12. The special conditions underlying successful schemes are indicated, and also the opinion is well supported that the success of labour co-partnership in gas undertakings is due to the privileged position of the latter as local monopolies with the legal sliding-scale of prices and profits.

Chapter 14 reviews the attitude of various sections of labour towards co-partnery, some regarding it as a "red herring," others as a device to divide labour, and others as a means to increase the "stolen wages" of Marxian theory. But it is established in Chapter 15 that when co-partnership is rightly applied and the share in profits takes the form of an actual share in the capital invested, co-partnership certainly does achieve the desirable end of consolidating the relations between Capital and Labour. Three primary conditions for success are laid down:—

(1) The proposed schemes must be a definite and detailed plan, mutually discussed, and agreed between the accredited agents of both parties.

(2) The full market or standard rate of wages must be given to the employees under the scheme, and the privileges of co-partnership should not be pitted against those of labour organisation.

(3) The benefits offered under the co-partnership scheme should be substantial and delivered in the form of Shares and not in Cash. Other subsidiary conditions

of success include the avoidance of gifts of shares in the favour of a contributory scheme, proper security for the shares acquired by the employee, the exercise of the usual rights of the shareholder by the employee-shareholder (excepting restricted conditions as to the disposal of the holdings) and, above all, courage and goodwill on the part of all concerned.

In Part 4, various other methods of sharing profits are reviewed, with examples and criticism—in particular, collective output, bonus schemes, and the sliding scale; the latter are favourably regarded by the author, especially in view of their success in the iron and steel trades, but the author is quite alive to the fundamental economic defects of giving the wage-earner direct interest in the high prices of the product. Collective bonus schemes are illustrated and well favoured, provided adequate precautions are observed to maintain quality, to protect the diligent, and to provide for periods of depression. We think the author would revise his views on the working of the sliding scale if a more detailed examination were made of its working in the coal industry; also, there is the fact that an employer may increase his profit and reduce his wage-bill, while prices are reduced, provided output is increased with falling unit costs of production. Gratuity bonuses, like a "tip," have no relation to efficiency. Provident Funds may provide the "bed in sickness, and the armchair in old age," but are a palliative rather than a solution of industrial difficulties. So also, as regards the incursions of the employer into the field of banker to his employees. The author pins his faith to Contributory Partnership, as, at any rate, a step in the right direction, and, we must admit, in Chapter 19, produces sound and numerous arguments in support of his contentions.

The views given in Chapter 20, as to the future of profits, are interesting; but this subject we fear is one upon which, even in optimistic moods, a chairman of directors would be loth to prophesy too confidently to an indignant meeting of shareholders. One thing, however, seems quite certain, as the author observes, namely, that some method must be evolved for avoiding the enormous losses and disputes between Capital and Labour as to shares in profits (and may we add, as to control of management) or we shall certainly kill the goose that lays the golden eggs. The book is provided with a useful index, and is well written in an interesting style, which is likely to attract more readers than usually appear for works on complex economic problems. Certain it is that no one in charge of modern industrial organisations should attempt schemes generally termed "profit-sharing" without first consulting this volume. —G. R. Carter.

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PROCEEDINGS

NOTES AND NOTICES

INSTITUTE'S AUTUMN CONFERENCE.

The annual Autumn Conference of the Textile Institute took place on the 12th and 13th October, at Manchester and Blackburn respectively. There was a satisfactory attendance, particularly from the point of view of representation of the various textile areas. Our record of the proceedings will appear in the November issue.

A FIELD FOR THE INVENTOR.

The extraordinary relative cheapness of crossbred wool is a phenomenon which does not seem to be fully accounted for by the many explanations offered, the chief of which, of course, is the insistence of fashion upon soft fabrics. Fashion has often shown in former years a strong preference of this kind, but the effect has not been so disastrous upon the market for strong coarse wools as apparently it is to-day. The position is strikingly shown by the following comparison:—

	70's. Merino Tops.	56's. Crossbred Tops.	50's. Crossbred Tops.	32's. Crossbred Tops.	Cotton. F.G.F. Sak.
1913 (Average)	30	23¼	21	15¼	10
1922 (September 7th).	63	32	21½	13½	17·25

The significant facts are that, while the price of merino this year has been about double the 1913 price, even a fine quality of crossbred (56's) has been only 40% dearer, and the lower grades are to-day actually from 10 to 15% cheaper. Again, in comparison with cotton, in 1913, 32's crossbred tops realised double the price of Fully Middling American cotton, and 50% more than the standard Egyptian quality; this year, Egyptian cotton has consistently realised a higher price than 46's crossbred wool, and even American cotton has run very close to, and sometimes exceeded, the price of 32's crossbred. Of course, it is well understood that since the slump there has been a heavy surplus of crossbred wools on the market, but the remarkable thing is that the low price has not stimulated a demand for them at a time when merino wools were in short supply and advancing to what seemed to the user impossible heights. The contrast with cotton is especially startling, and seems calculated to make an end of the slogan "Guaranteed Pure Wool." A multitude of uses have been found for cotton during recent years, and there is evidently a field for investigation as to new methods of utilising crossbred wools, whether for clothing or for other purposes. —F. J. N.

ADVERTISEMENT.

CHIEF CHEMIST or CHEMICAL ENGINEER WANTED, thoroughly familiar with, and with actual experience of, the manufacture of viscose artificial fibres, to assume technical control of new plant now in course of construction in United States. —C. E. Camillo, Marcus Hook, Pa., U.S.A.

A MANAGERIAL APPOINTMENT.

Mr. A. E. Gaskin Brookes, a member of the Council and of several committees of the Institute, has relinquished his position as lecturer and designer of textiles at the College of Technology, Manchester, and returned to direct participation in industry, having been appointed principal manager of the cotton spinning and weaving mills of the Hollins Mill Co., Ltd., at Marple and Hazel Grove. In addition to the duties he fulfilled at the Manchester College of Technology, since 1914 Mr. Brookes has held the appointment of lecturer and examiner in design at the Salford Royal Technical College and, during the same period, has acted as examiner for the Union of Lancashire and Cheshire Institutes. So far as the Textile Institute is concerned, he has devoted considerable time and energy to the development of the Crompton Prize Scheme and to the organisation of special exhibitions of textile fabrics.

TECHNICAL AND SCIENTIFIC LIBRARY.

A new technical and scientific library has been established at Manchester, and forms part of the general library accommodation on the Piccadilly site of the municipality. The library includes an excellent collection of books, pamphlets and periodicals relating to natural science, mathematics, astronomy, physics, chemistry, geology, palæontology, biology, botany, zoology, useful arts, medicine, engineering, agriculture, domestic economy, communication, chemical technology, manufactures, mechanical trades and building, and also specifications of British, United States and some Colonial patents. —L. M. S.

TEXTILE AGREEMENTS.

There has been quite a crop of agreements recently in the textile trade, each one important, and collectively of no little moment. In the finishing sections of the cotton trade, the India section of the Manchester Chamber of Commerce have managed to put things on a more regular basis by hammering out schemes whereby delivery of goods for printing or bleaching is to be done by a guaranteed date, and, in return, the handing back of the treated material is to be done by a guaranteed time. There is further an agreement whereby shipping rates by the Conference Lines to Bombay and Karachi have been substantially reduced, the Lines of course getting a *quid pro quo*. Still more lately is an arrangement between employers and workers in the dyeing and bleaching trades to set up a scheme of compulsory arbitration, and to give it a trial for an agreed period. All this surely means a better state of affairs in the trade, not only on the strictly commercial side, but also a better state of affairs between management and workers. The former conditions have been looked for for some time, and they seem to be the beginning of even more better things. Better relations between management and workers are not to be despised; they are in fact essential to the proper conduct of any industry. The experiment will be watched, as a successful example goes a long way, especially when it is being tried at one's very door. —R.C.

GENERAL ITEMS AND REPORTS

THE LINEN INDUSTRY RESEARCH INSTITUTE.

A visit of inspection to the above-named Institute, by Sir Wm. McCormick and Sir Frank Heath, the Chairman and Secretary respectively of the Department of Scientific and Industrial Research for Great Britain, revealed some of the work being done by the Linen Industry Research Association under the directorship of Dr. J. Vargas Eyre, M.A., Ph.D., F.I.C., at the Linen Research Institute at Lambeg, near Belfast.

Research work was commenced at the Institute in March, 1920. Since then there has grown up an organisation which, it is confidently anticipated, will exert an important and far-reaching influence on the linen industry, by the application of scientific method and work to every phase of the industry, from the sowing of the seed to the sale of the finished articles of manufacture. The Institute comprises three main laboratories, which are equipped for scientific work in Botany, Chemistry and Physics; three laboratories equipped for the more technical operations involved; a constant-temperature-humidity room; a room for microphotography, and one for ordinary photographic work; a reference library; workshop; power house; and large storage accommodation for crops raised upon experimental plots.

The work at present being carried on bears mainly upon fundamental problems connected with the industry. For example, on the botanical side, a great deal of attention is devoted to the study of the heritable character of the flax plant, with a view to further extending the successful work in raising improved strains of flax for commercial purposes. From a study of the fibres of flax, hemp, and ramie, a very complex yarn-like structure of their so-called ultimate fibres has now been revealed. This has led to the development of a ready method of distinguishing these fibres, one from another, at all stages of their use in manufacture, and it is likely to throw considerable light upon the question of mercerising and finishing of linen, and also upon the problems connected with the dyeing of fabrics. Considerable progress has been made with investigations of the retting process, and with mercerisation problems. On the physical side, much useful information has been obtained from a study of the behaviour of yarns under stress-strain condition and the influence of twist, humidity, and other factors upon their weaving quality.

An extensive collection of works of reference is being brought together, and a review of current literature, bearing upon flax, hemp, and ramie, is supplied each month to subscribing members of the Association.

INTERNATIONAL COTTON BULLETIN.

The Committee of the International Federation of Master Cotton Spinners' and Manufacturers' Associations has undertaken the publication of an International Cotton Bulletin, to be issued four times a year, approximately every quarter. The International Statistics of Cotton Mill Consumption will be incorporated every half-year. The first issue, September, 1922, includes the following interesting items:—Reports on the State of Trade; Mill Consumption and Mill Stocks for the half-year ended July 31st, 1922; Development of Cotton Spinning, Doubling, and Weaving Industry in Switzerland; Cotton Mill Statistics from China, India, and Japan; Cotton Growing (particularly in new fields); American, Egyptian, Indian, and Brazilian Cotton Crops; Effect on Mill Production of the 48-hour week; Reasons for the lack of demand for Cotton Goods.

The Official Report of the Eleventh International Cotton Congress of Representatives of Master Cotton Spinners' and Manufacturers' Associations, held at Stockholm, June, 1922, issued by the above Committee, is also to hand. The papers prepared for the Congress are given in full in the Appendix. —L. M. S.

CITY AND GUILDS OF LONDON INSTITUTE—DEPARTMENT OF TECHNOLOGY.

The programme for the session 1922-23 (price 3/6 net) contains general regulations and syllabuses for examination in technological subjects and for teachers' certificates. The following are the chief alterations in the current programme relative to the Textile Industries:—The syllabuses in Woollen and Worsted Spinning and Weaving have been revised, new syllabuses in Engineering as applied to the Cotton Industry, the Economics of the Cotton Industry, and Chemistry as applied to the Cotton Industry, have been added in the Final Grade. Alteration has also been made in the conditions of award of the Drapers' Company Scholarships and Exhibitions. These scholarships and exhibitions are awarded to candidates who have been definitely employed for required periods in some branch of the textile industry, on the results of the City and Guilds Examinations in the Woollen, Cotton, Linen, Silk and Jute industries. The exhibitions will be of the value of £10. The scholarships will be of two kinds—minor and major. The minor scholarships will be of the value of £20 per annum, tenable for two years, and the major £100 per annum, tenable for two years. —W. N.

MANCHESTER COLLEGE OF TECHNOLOGY—DEPARTMENT OF INDUSTRIAL ADMINISTRATION.

The prospectus of the above department, for the Session 1922-23, commencing 5th October, gives details of full-time and part-time courses to be held in Industrial Administration and Industrial and Social Welfare. The part-time courses are designed to meet the requirements of individuals already engaged in industry and commerce, and it is also proposed to arrange for a series of special lectures on specific subjects during the session, particulars of which will appear from time to time. The department will also render assistance, where required, to outside societies and associations in the choice and recommendation of lecturers.

The broad object of the department is to help in the building up of a science of industrial administration and to put all knowledge obtained at the disposal of the business community, from whom, also, it will no doubt eagerly welcome constructive criticism and assistance generally. The facts out of which the science is to be built, as revealed by the syllabus of work, are drawn, in one way or another, from an immense field of human activity—social, political, and economic. To construct a science on such broad ground is a lofty ideal; it is also a gigantic task. —W. N.

AGRICULTURAL DEPARTMENT, ASSAM.

The Report of the Agricultural Department, Assam, for the year ending 31st March, 1922, is to hand, and contains details of researches in jute varieties, etc. A survey of the cottons grown in this province will be taken up this year. —L. M. S.

DEPARTMENT OF AGRICULTURE, PUNJAB.

Part II. of the Report of the above Department for the year ending 30th June, 1921, contains details of entomological investigations, the bollworm and its parasites having been especially studied, and of cotton variety tests carried out at the Hansi Agricultural Station. Progress in sericulture has been remarkably rapid: 1,762 ozs. of silkworm eggs were distributed in 1921 as against 600 ozs. in 1920, and arrangements have been made to distribute 3,000 ozs. of seed next year. —L. M. S.

DEPARTMENT OF AGRICULTURE, MADRAS.

The Report of the Operations of the Dept. of Agriculture, Madras Presidency, for the official year 1920-21, gives details of progress in research in cotton growing, including the improvement of Cambodia cotton and an investigation on the chief insect pests—pink bollworm and stem weevil. As regards sericulture, a method of cleaning silk waste is being taught to reelers and is expected to result in a considerably higher price being obtained from waste. —L. M. S.

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PROCEEDINGS

INSTITUTE'S ANNUAL AUTUMN CONFERENCE.

PROCEEDINGS AT MANCHESTER AND BLACKBURN.

The Annual Autumn Conference of the Textile Institute was held on Thursday and Friday, 12th and 13th October, at Manchester and Blackburn respectively.

The proceedings on the first day opened with attendance, by special invitation, at the Exhibition of Textile Machinery and Accessories, at the City Hall, Manchester. There was an excellent gathering of Institute members from various districts, and the exhibits were viewed with considerable interest. The exhibition visualised recent progress in mill equipment in an effective manner, and, whilst the space available could not admit of anything like a complete range of exhibits of textile machinery in general, yet particular features contributed effectively towards providing a substantial indication of modern trend and practice in regard to plant and machinery equipment. A noteworthy feature was the obvious excellence of quality associated with the productions of the engineers and machinists. The wide range of exhibits with reference to driving problems formed a forceful reminder of the prevailing activities to secure advances in this important direction. The strides being accomplished in regard to the equipment of the knitted goods factory were well reflected in the exhibits in this connection. Humidifying and atmosphere-purification apparatus were much in evidence. The exhibits, as a whole, clearly demonstrated that the march of progress in regard to mechanical means of production continues to be pursued with unremitting zeal.

Luncheon was served within the exhibition hall, and the President of the Institute (Mr. John Emsley, J.P.) voiced the thanks of the members of the Institute to the promoters for their invitation.

In the afternoon, at the Institute premises, a meeting of the Council of the Institute took place, at which the principal item was the confirmation of the minutes of Committee in reference to the proposal to seek to obtain a Royal Charter for the Institute—a movement which is receiving the very heartiest support of the President, and one which, as Mr. Wm. Frost pointed out, could not be contemplated in the absence of the President's generous attitude in the matter. Another item of interest before the Council was that of the election of about fifty new members of the Institute—a result largely achieved by a personal appeal on the part of the President to existing members.

THE USES AND ADVANTAGES OF ELECTRIC POWER IN THE FACTORY.

Paper by J. F. CROWLEY, D.Sc., B.A., M.I.E.E.

In the course of this paper, the lecturer said he proposed to endeavour to present an idea of the great textile industry in India, of what electricity had done for it, and of what electricity might do for industry at home if the opportunity were afforded. It was as well to remember that the whole of the jute crop was grown within the Empire, and over two-thirds of it converted to manufactured goods within it. The splendid factories which the Scottish pioneers had planted on the banks of the Hoogly provided over 270,000 persons with employment, and represented 800,000 spindles and 40,000 looms. The buildings themselves were such as even Lancashire might be proud of, while the driving arrangements in many cases were in advance of Lancashire or Dundee. Electricity was in general use, and the power was from central stations which were in some cases put up by associated groups of manufacturers. The individual electric drive attested the progressive character of the textile manufacturers in Calcutta, and also in Bombay, and while their enterprise and energy were to be admired their competition could not be ignored. Manufacturers in India were undoubtedly preparing to invade territory which Lancashire and Dundee had hitherto regarded as peculiarly their own. Jute fabrics previously not made outside Dundee would shortly be produced in increasing quantity by India's manufacturers, and where they considered Indian conditions unfavourable they were arranging to manufacture with Indian capital and under Indian control outside India. Therefore, it behoved the home manufacturer to do everything possible to improve the manufacturing processes, particularly from the point of view of increased productivity. More and still more productivity must be the slogan in home industrial circles. He did not mean merely increased production, but increased output from each existing factory, and to this end both finance and labour must be increasingly devoted. Speaking in London recently, Sir John Snell, the eminent engineer and chairman of the Electricity Commissioners, stated that our nation, left poor in the material sense after the Napoleonic wars, would not have made the recovery it did but for the invention of James Watt. The nation at the time did not recognise the fact. We needed recovery to-day, and Sir John Snell gave it as his opinion that electrical development was going to be an important factor in effecting the recovery. As in previous cases, the country did not recognise this as it might do. When he (Dr. Crowley) was invited to speak that day on the subject of Electricity, it was suggested to him that textile manufacturers were tired of hearing about electric power. But he ventured to say that they could not hear too much about electricity properly applied. Electricity could improve productivity by (*a*) ensuring reliable running, (*b*) maintaining average speeds within defined limits, (*c*) keeping cyclic irregularity in speed within defined limits, (*d*) securing prompt starting and stopping of individual machines, and (*e*) providing for a flexible drive for machines which have inherent variations in torque. It was to be remembered that increased productivity could be secured by improved driving without any cost due to increase of building spaces, or productive machinery, or rent, rates, and taxes. The effect on profits, therefore, was consequently striking. Herein lay a solution, if not indeed the only solution, of the problem facing manufacturers to-day. Productivity was important at home because even in the best of Indian factories that particular factor was not good.

DISCUSSION.

Col. F. R. McConnel (Manchester) said that while most of them were anxious to keep pace with development yet cost had to be taken into serious account.

Mr. Frank Arrowsmith assured the lecturer that manufacturers in Lancashire were not asleep to possibilities, but the cost of current was involved. So far as getting even a 50 per cent. increase on profits by means of a comparatively small increase of percentage of production was concerned, he feared that even 50 per cent. would not amount to much in these days.

Dr. Crowley said he had never claimed saving in power. Any saving in that direction was not worth talking about, and even a 50 per cent. saving in the power bill was nothing compared with 1 per cent. of increased output. He left the question of saving of power to people who preferred to split hairs. There was only one claim for electricity—increase in the productivity of the machines. What was the cost of power in relation to actual turnover? If it were 5 per cent. he should be amazed. There had been far too frequent a tendency to consider the whole question as one of Steam *versus* Electricity, which formed a wrong basis for consideration and discussion.

Mr. G. B. **Williamson** (Preston) said that it was difficult to get true comparisons between factories owing to particular conditions. There was no impartial authority which could be appealed to, and he thought the whole subject was one for a special committee. He supposed that the extra cost of the individual electric drive would be in the neighbourhood of £25 per loom, and there was a natural hesitancy unless production were guaranteed. Instances were known where results had been disappointing. On the other hand, too often the conditions before the change to electric driving were not comparable. He was convinced that the time would come when more consideration would have to be given to these matters apart from consideration of £. s. d. and production figures. Hygienic and æsthetic considerations would assert themselves, and concentration of power in one big station would help in that direction.

Mr. F. **Anderson** (Portadown) testified to an experience of individual electric drive on a certain class of fabric yielding a result even beyond expectation.

Mr. **Oscar** S. **Hall** (Bury) moved a vote of thanks to the lecturer, and suggested that at some future date even power might be imported. Individual electric drive was certainly best for complex looms.

Mr. J. G. **Crawford** (Belfast) seconded, and said he thought most of those present would leave that room with better ideas of the whole matter. He agreed with Dr. Crowley as to the importance of knowing what the performances of power units were at various places.

The **President of the Institute**, in declaring the meeting closed, agreed that the lesson involved was that closer inspection of plants was necessary.

CONFERENCE AT BLACKBURN.

The Conference proceedings were continued at Blackburn on Friday, the 13th October, when the members attended at the Municipal Technical College. The President (Mr. John Emsley) again occupied the chair.

At the outset, Mr. F. J. Harlow, the Principal of the College, extended a hearty welcome to fellow-members of the Institute. In many respects, the Institute and the College had interests in common, both being concerned with the advancement of the great textile industry and interested in bringing men engaged practically in the industry into touch with those more particularly interested in the technical side and in scientific pursuits. They were proud of the textile department of their college and those members who took opportunity to inspect the department that day would, he hoped, be convinced that the pride was justified.

The President of the Institute acknowledged the expression of welcome and, in calling upon Mr. C. F. Cross to contribute the Mather Lecture of the Institute, said that this annual lecture represented one item in a scheme of development which the Institute had taken in hand. The next effort was to be in the direction of securing a Royal Charter for the Institute—a matter which should be of particular interest to the younger students. The aim was to raise the level of the profession of textile technology to that associated with the technology of many other industries. He noticed that at Blackburn they had a most active Textile Society. These societies exerted a great influence in the right direction and he hoped that ultimately they would all be definitely linked up with the Institute in some way or other.

THE TEXTILE INSTITUTE ANNUAL MATHER LECTURE.

THE DEVELOPMENT AND FUTURE OF THE PRODUCTION OF ARTIFICIAL FILAMENTS FOR THE TEXTILE INDUSTRY.

By C. F. Cross, F.R.S.

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Before accepting the invitation of the Institute to discourse on "Artificial Silk," I hesitated under the consciousness of superficial knowledge and experience of the primary textile industries. As a "Mather" lecture, however, a treatment of the subject is suggested independent of any qualifications of textile specialist, which I formally disclaim. I was associated with William Mather in a campaign of technical progress in the methods of bleaching cotton and flax textiles in the period of 1885—1890, which ante-dated the discovery of viscose (1892); and the systematic work which led up to this was incidental to the general investigation of the relationship of cotton cellulose to alkalis, which underlies the chemical-mechanical processes of bleaching and finishing.

The "Mather" kier and process arose out of a demonstration to William Mather of the effect of steaming cotton goods saturated with a 2% NaOH lye—devised as an improved preparation of cloth to be bleached on the continuous system which he had designed to carry out the Thompson chemicking process (*J. Soc. Chem. Ind.*, 1884: E. Patent 595/83.)

As a personal reminiscence and tribute to William Mather's technical perceptiveness—in fact, genius—it may be recorded that the design of the kier to carry out the systematised process followed within a day or two, and the records of Mather and Platt would no doubt confirm my estimate of the design as originally perfect.

These records, if and when brought to light would give technologists an interesting example of evolution of a process in technical and economic detail through the stages of Market and Printers' Bleach (cotton piece goods), Bump Yarn and Paper-makers' rag bleach, Flax damask, and, lastly, the fine linen Bleach. While this development involved no novel principle or process in regard to the chemistry of cellulose purification, it administered a critical "shake up" to important sections of the cellulose industry. It synchronises with another development involving the relationship of cellulose to alkalis, the re-investigation of John Mercer's neglected and then almost forgotten transformation of cotton goods under the action of the alkaline hydrates. The story of "Mercerisation" deserves a brief mention in this connection, not only for its intrinsic interest and many paradoxical features, but by reason of its influence on the development of artificial silk. It would be obvious to any student reading the life of John Mercer, in the interesting setting which we owe to E. A. Parnell, that his investigations, while exhaustive, on the level of the science and technology of his day, were eloquent of unexhausted possibility. In the one direction, these were realised by the pioneers of the modern methods of mercerization; but, on the side of pure chemistry, there were indications of a general reactivity of Mercer's "Alkali Cellulose," and it was through a study of its interaction with benzoyl chloride, that it became obvious that the Alkali Cellulose would react with carbon bisulphide; and so much so that the first preparation of the Cellulose-Sodium Xanthogenate (April, 1892) was made under the quantitative conditions of the present-day industrial Viscose process.

On a retrospect, it appears that this discovery was implicitly patent to many earlier investigators: thus, in the *Ber.*, 1875, 8, 802 and 955, Zoeller & Grete deal with the special application of alcoholic xanthates in vine-culture, for the destruction of the phylloxera. To overcome certain defects of the methyl and ethyl salts, they worked through a series of alcohols of higher molecular weight to find that the amyl-xanthate fulfils all the conditions of the chemical-biological-industrial specification. That these workers did not extend their generalization to the carbohydrates and cellulose as "alcohols" is, therefore rather a psychological accident. As it was, Viscose waited 20 years and a series of incidents for its debut; "Mercerization" waited 20 years for full industrial realization, but after a specific "discovery" of effects, and a categorical investigation of immediate causes. So it is in the textile world: with a necessary tide of evolution, *i.e.*, of technical progress, there are counter streams, and eddies of routine, convention, and polarised thought, which require to be broken by some incursion from without to liberate an idea for its normal movement towards realization.

The year 1892 has been mentioned as the date of appearance of the actual Viscose; but in regard to our main theme other dates are of greater moment. In my personal view of this field, the date 1883 is prominent as marking the awakening of the technical world to the possibility of an artificial silk. In the order of time, we shall no doubt possess a complete history of Hilaire de Chardonnet's invention—invention in the full and true sense of the word—the "genial" idea, the flash of conception, the early realization in the laboratory in the concrete form of thread, to be followed by the long, drawn-out threads and complex tissue of technical-financial evolution. On a retrospect, it again appears that there intervened an incubation period of some 20 years, which, by the way, is quite a usual if not the normal average for inventions, in this field, of "great pith and moment." In view of the complexities of the cycle—Cellulose–Nitric Ester–Cellulose—and of the problems of chemical engineering involved; and, next in order, of the textile conditions to be fulfilled in regard to production and application of the thread; and, lastly, of the psychology of the world of promoters, adventurers, and an inarticulate public through whom the ultimate realization of the industry requires to be worked, the period of incubation in this memorable case is not inordinate.

On personal memory, the next prominent date is 1900, which marks a Paris Exhibition, the triumphant exposition of the "Soie Artificielle Chardonnet," in the convincing form of "*toiles de luxe*," high selling prices of the yarn, and a feverish market in the shares of the parent industrial company.

A development of this "Collodion Silk," of secondary importance, was associated with the name and work of Lehner, who elaborated a simplified method of spinning or drawing the collodion to thread. The Chardonnet process of forming the solidified thread (of cellulose nitrate) by evaporation of the volatile solvents, was replaced by the method of precipitation or coagulation by the action of water, the water of the spinning bath taking up the alcohol, and, in part, the ether of the collodion, to be afterwards recovered by distillation. Both Lehner and du Vivier appear to have exercised ingenuity in the unpromising field of compound colloids as the basis of a textile thread—mixtures of nitro-cellulose with protein-colloids, oxidised derivatives of drying-oils, and the like, to use the terminology of patent specifications.

But in the period 1890—1892, during which the Lehner process was demonstrated at Bradford, these complications had already been shed—tried and found wanting—in favour of simple and specific variants of the Chardonnet technique, which had been set forth in his communications to the "Académie des Sciences" (1884-7)—"Sur une Matiére Textile Artificielle ressemblant à la Soie."

Lehner's activity in this field, and the development of an industrial production, is probably connected with the initiation of the "Glanzstoff" undertaking which developed the alternative process—the third of the major cellulose methods—based on the cuprammonium solution of cotton cellulose.

The perfected industrial and highly successful system, is a resumé of the labours of Pauly, Frémery and Urban, and Bronnert.

The evolutionary struggle between these three major systems is a matter of history; the conditions which have limited the dominance of the nitro-cellulose process to an episode—albeit of exceptional brilliance—and the cuprammonium process to a partial permanent survival, on the basis of technical superiority of certain products, are generally known in the textile world.

At the present day the dominant position has passed to the viscose process, and this opportunity offers to put on record some features of its developments which are not generally known. The following points are selected with regard to the limitations of a lecture as distinguished from a closely reasoned, scientific-technical communication.

To develop the new cellulose derivative in its many industrial applications, there was formed a proprietary syndicate—The Viscose Syndicate Limited—with a cash capital of £4,000 contributed by the late Alfred Nobel and Andrew Pears. In due course, the syndicate was approached by the late C. H. Stearn, who was well-known in connection with the highly technical industry of incandescence lamps, for a licence for spinning cellulose filament to be carbonised for use in this industry. The study of the technique of the process by Stearn and his assistant, C. Topham, resulted in the undertaking of the extension to textile filaments. To deal with this matter, there was formed the Viscose Spinning Syndicate, again with a cash capital of £4,000. This was formed jointly with the Continental Viscose Company, which had been formed for parallel developments in Continental countries. The success of the new venture, in the hands of Messrs. Stearn and Topham, is, on retrospect, quite remarkable, and those who now work the industrial process yield generous tribute to the work of these two men. In view of the extreme complexity of the technical problems involved, firstly in the viscose preparation, secondly in the process of conversion into thread, and thirdly in the evolution of a manufacturing plant at Kew to an effective industrial unit, it is one of the most extraordinary cases in technical history. In evidence, the subjoined note which covers quite a number of fundamental technical points, has been prepared as a resumé of the experience of those who have been carrying on the work of technical control and research in the factories of the various Viscose companies. It is only necessary to add to this note that the evolution of the matter at the Kew works passed through the stage of parallel drawing to the integrated centrifruge system, and it was no doubt this very important simplification and condition of large output which gave great advantage in a competition which on the system of parallel drawing would have been more severe.

NOTE OF CRITICAL RETROSPECT: AGREED WITH TECHNICAL STAFFS OF REPRESENTATIVE VISCOSE—SILK FACTORIES, 1922.

The experimental plant for the manufacture of viscose silk, designed and erected at Kew by Stearn and Topham, and its rapid improvement to the stage of actual production of a merchantable "silk," was a marvellous example of technical insight and grasp of principle, for it comprised the use of the pump for controlling the viscose delivery for the unit multiple thread, metallic spinning nozzles with multiple perforations of minute diameter, and the centrifuge-box for collecting and laying the thread and imparting the required twist, which are employed to this day in producing what is probably the larger portion of artificial silk. These have been modified in detail by many workers, particularly by J. Clayton, and the number of variations patented is now considerable. The principle of parallel spinning directly on bobbins and twisting afterwards, which was developed at an early date in the viscose factories of Germany and Italy, has survived, and is turning out the "silk" in large quantities, but experts cannot agree as to the relative merits of these two processes. The very desirable method of rotating the spinning jet itself, so as to twist the thread before winding it on to a bobbin, has attracted much inventive ingenuity, but the considerable difficulties which arise in practice are still to be overcome.

With regard to secondary details, an enormous number of variations have been proposed, but most of these show more ingenuity than knowledge of the practical problems of artificial-silk manufacture. On the chemical side, almost every possible and many quite impossible substances have been proposed as additions to the viscose and to the spinning bath.

Substances have been added to the viscose with the purpose of modifying the cellulose to a thread of greater softness and resistance to water, also for reducing the rate of ripening of the viscose so as to obtain a more stable product. For these and other purposes, the addition of the following have been proposed :—Sodium silicate, sodium aluminate, soap, sodium thiosulphate, glycerine, glucose, urea, salts of resinic acid, phenol-formaldehyde condensation products, albumen, turpentine, and naphthenic acids.

The chemist has a greater latitude with regard to the possible components of the spinning bath and this has resulted in the following list of substances proposed for this purpose :—Sulphuric, hydrochloric, formic, acetic, lactic, citric, tartaric, glycollic, and aromatic sulphonic acids; sulphates of ammonium, sodium, magnesium, iron and zinc; chlorides of sodium and ammonium; sodium sulphite, bisulphite, and thiosulphates; alcohols, starch, sugars, molasses, aniline, glycerine, aldehydes, ketones, and lignone-sulphonic lyes.

The principal development in this respect, which was foreshadowed by Stearn and Woodley in E.P. 2529 of 1902 for spinning a purified viscose, has been the use of acid solutions for spinning so as to get a cellulose thread directly instead of a cellulose xanthate thread which has to be subjected to further treatment to regenerate the cellulose. Since then, the value of both salts and acids has been fully appreciated, and various mixtures of these two classes of substances have held the field, the use of organic substances such as glucose having proved valuable on account of their effect in modifying and softening the action of the acid constituent.

So far, viscose, in spite of its undoubted merits has not shown the facility possessed by cuprammonium solutions of being spun into very fine filaments, as is being done by Bemberg and Holken. One looks forward with interest to the working of recent patents of E. Bronnert in this connection, which claim to produce the thread in a range of 5—2 deniers and to extend the industry in the direction of substituting silk (*J. Soc. Dyers and Colorists, June*, 1922).

A certain amount of confusion exists in the literature on this branch of the subject, particularly in patent specifications, where it may be not altogether accidental. A typical example is in a German application of W. Vieweg, which states that, while it has been proposed to draw out in order to obtain fine filaments, the inventor spins filaments of 1—3 denier direct from jet openings of 0·09 mm. diameter, it being quite obvious that, other conditions being constant, with a given aperture the sole condition which governs the fineness of the filament is the extent to which it is possible to draw it down in diameter.

The scientific control required in this industry is necessarily very elaborate and has necessitated the working out of new and special analytical processes suited to the examination of substances about which very little has been published. The control of the composition of the wood-cellulose raw material, alkali-cellulose, cellulose-xanthate (viscose), spinning baths, etc., calls for a considerable chemical staff. The number of samples tested weekly at one of the factories, as far back as 1914, was 1,700, and the number of separate examinations made was 3,300.

The qualities of the finished product also require careful study; the regularity of its chemical composition, lustre, extensibility, tensile strength both dry and in the wet state, affinity for dye-stuffs, etc., must be carefully controlled. An interesting point is the influence of the contour of the filament on its textile qualities. This factor is largely dependent on the composition of the spinning bath, and variations in this respect show themselves in alterations of lustre and covering power. In the early days of the industry, this was considered by the textile consumers to result from variations of specific gravity.

In the control of contour, the filament is examined in cross-section and the microscope mounts are photographed for actual measurement and for permanent records. The cross-section also affords useful though not absolutely conclusive evidence as to the method of manufacture of a given sample, and in some cases even has enabled one to identify the factory in which it was made.

The contour is governed by the manner in which the original cylinder of cellulose solution contracts during the operations of coagulation and dehydration. Three broad classes of section may be distinguished :—

(1) The whole filament contracts slowly and evenly, giving a fairly regular section.

(2) The outline remains smooth while the walls contract inwards, giving an irregular shape with a smooth surface.

(3) The walls become corrugated in an attempt to adjust the original circumference to a diminished sectional area.

These three classes correspond approximately to :—

(1) Cuprammonium and early viscose silk.
(2) Nitro and acetate silk.
(3) Modern viscose silk.

A striking demonstration of these differentiations of form and surface is submitted in the convincing form of photo-micrographs of sections of typical specimens. The photo-micrographs also illustrate the advanced technique of the routine control of the processes involved in the production of artificial silk.

A note may be added of the actual factors of the processes or manufacturing operations requiring control :—

1—RAW MATERIAL : Cellulose of " standard " quality; composition in terms of α- and β-cellulose (resin and ash); viscosity of 7% (cellulose) solution. Condition, at moment of treatment for

2—ALKALI CELLULOSE : NaOH % of lye; temperature; ratio cellulose-NaOH-water in finished product—Apparent volume of alkali cellulose. Ageing process : Closed vessels—constant temperature—variable time.

3—VISCOSE PROCESS : Temperature and duration of reaction (CS_2) to reach optimum condition for solution of Xanthate; followed by filtration and ageing or ripening.

4—DRAWING OR SPINNING : Perforation of spinning nozzles to orifices of 0·1 mm.; composition of precipitating bath; temperature; speed of drawing adjusted to supply of viscose (control of denier of yarn).

5—WINDING OF THREAD (hydrated cellulose with sulphur by-product of reaction, and absorbed liquor from spinning bath) followed by operations of washing, de-sulphuring, bleaching, and drying.

The yarns are finally handled by experts and sorted into grades or qualities. A well-controlled manufacture will give 60% first quality " silk " and a total yield of saleable silk 75% of the cellulose (wood-cellulose of 90% α cellulose). The losses are made up of the cellulose de-graded to soluble forms, and of viscose in the stages of filtration, distribution, and in the spinning bath.

Resuming the thread of history, it must be very briefly recorded that the Spinning Syndicate early arranged for the cession of German patents and rights to Prince H. von Donnersmarck. Almost simultaneously, and following the Paris Exhibition, a financial industrial group was attracted to the French industry. The Société Française de la Viscose was formed, and for the early development a favourable location was found at Arques-la-Bataille, near Dieppe. A tribute is due to the French group and their spirit of adventure; they not only took up the spinning of " silk " but the whole of the possible applications of the new derivative, which they studied systematically and brought at least four other industrial developments to a successful realisation. Of these, we must mention the " Crin," which is a flat filament of high lustre used in millinery and other decorative arts; and next in order the film fabric known as Cellophane, which is also a development of the artificial silk process, being in essential particulars an identical treatment of cellulose. This fabric, which is drawn through a fine orifice, solidified as a hydrated cellulose, as a web of 1·5 metre breadth, is drawn forward and treated on continuous machinery to finish as a web of 1 metre width at the end of the machine. This, again, is a case of industrial realisation through phases of excessive difficulty for reasons evident to all technologists. It should thus be recognised that the Société Française has been the effective pioneer of Viscose from the industrial point of view. The English textile enterprise, now Anglo-American, in the hands of Messrs. Courtaulds and pioneered through its more difficult phases by the late Mr. H. G. Tetley and his co-director Sir Thomas Latham, presents on retrospect many arresting features of industrial pioneer work. Success is its own exponent, and the exceptional causes of the success of this enterprise are perhaps well known to the textile world.

This is a brief and, in fact, scrappy note of technical history. Our present-day workers, although no doubt more interested in the future, will be aware that the past has a determining influence which should not be neglected on any enquiry, whatever its purpose, and that in regard to the future it is necessary, for progress, to take the widest possible view of the industry, such width of view requiring a certain detachment—to be in the industry, perhaps, and yet not of it. This is the more important function of the individual, with the growing complexity of science and technology. From the foregoing Note of Critical Retrospect, which represents, in appreciative review, the results of many years of work and experience, we may conclude that in the viscose section of the industry there has been little progress affecting primary factors. Some secondary variations, studied by exact method and then controlled, have developed textile quality and value; but the literature of patented inventions bearing on the industry is evidence of competitive activity rather than of grasp of method and fundamental perspective.

This statement probably holds for the rival processes, the Nitro-Cellulose and Cuprammonium variations : the period 1900—1922 has been one of technical-industrial and consequent commercial development of the position fundamentally established 20 years ago.

In the meantime, a new competitor has taken the field as an industrial *fait accompli:* the Cellulose Acetate thread arrives, again after an incubation period of 20—30 years. As an abstract proposition, this has been present to the scientific-technical world since the acetate was produced on the manufacturing scale in the period 1890-92 (Cross & Bevan—C. O. Weber).

In the later development of the product and its applications, a number of distinguished workers and corporations have taken part, *e.g.*, Lederer—Donnersmarck, Knoevenagel—Knoll, Eichengrün—Bayer—and, latterly C. & H. Drefus—British Cellulose Company. This last named undertaking, as representing the *fait accompli* referred to, claims the serious critical notice of the technical world, as it has secured the interested attention of the general public and considerable support from the investing public.

We are, therefore, at this date, interested spectators of a highly complex, evolutionary struggle, involving many dramatic elements. It is all the more important to use the present opportunity to insist on the fundamental factors of science and their determining influence on the struggle, and to remind the individual that, in forming his critical estimate of the industrial future, he should be able to apply the criteria of science with the detachment of the student.

As an illustration and vindication of " detachment," I would like to point out to this audience that Stearn and Topham accomplished a revolution in the textile industry in two years' work, starting from the zero of experience, or inexperience, and perhaps the popular level of knowledge of the arts of spinning and weaving upon which " cotton " and " linen " are interchangeable terms! Such knowledge, or ignorance, would be regarded in Lancashire as pitiable, and the epithet need not be qualified, save by reminding ourselves of our own sectional ignorance and of what is in fact a universal experience—the greater the light, the deeper the shadows. In the special instance, to put the matter more logically, the positive working basis of invention was (1) The command of experimental method, (2) the fore-reaching grasp, which is faith, (3) the moral discipline which rejects the imperfect and ineffective, *sans phrase,* as steps to the final realisation and takes the pleasure of the craftsman in handing it over as good value to the ultimate purchaser. Ignorance of a particular industry, in this and other cases, is overborne in objective effort based on the very essence of science—*ab uno disce omnes*—with its message of consolation to the worker conscious of his many-sided ignorance.

This is only a parenthesis, by way of introduction to a general case or problem which may be formulated in the terms :—What is the maximum technical effect to be realised with a given weight of cellulose? In the endeavour to solve this major or general problem, the student will find that most of the problems in this field are implicitly involved. He may be a shareholder in Courtaulds, or the British Cellulose Company; he may be a spinner, dyer and finisher, textile manufacturer, or merchant; he may be eager for knowledge or a curious enquirer. In the prospective enquiry, which is disinterested and unprejudiced, he must subordinate any personal interest to its objective, which, in the main, is one of science. This is another aspect of the discipline of detachment.

After some consideration, I find that the following typical industries may be compared in regard to the solution of the problem :—

(1) Cotton Spinning—The production of 100's combed weft yarn.

(2) Paper-making—The production of a tissue paper of 15 grms. per square metre.

(3) Artificial Silk—of 9×7 deniers, *i.e.*, 60—70 den.

The next section of the Lecture, devoted to the elucidation of the comparison, in terms of the following data, may be put on record in the shortest possible terms.

COTTON YARN MANUFACTURES—GENERAL DATA—SPINNING OF 100's COMBED WEFT.

Taking four more or less typical cottons to give the figures in the accompanying table, the cottons are :—

(1) Super Sea Island, a high grade pedigree cotton isolated by Harland. Although the values it gives are comparable with the best commercial St. Vincent, which is the finest cotton found on the market, it is definitely superior to the commercial supply and is undoubtedly the prize cotton of the world.

(2) Egyptian : This is a typical high grade Sakel.

(3) American : This is the average of a number of good quality, medium staple, Upland cottons.

(4) Rough Peruvian : A typical commercial sample.

TABLE.

	I. Super Sea Island.	II. Egyptian.	III. American.	IV. Rough Peruvian.	Average.
Commonest Length (in inches)	2	$1\frac{3}{8}$	1	$1\frac{1}{4}$	—
Approx. staple length (in inches)	$2\frac{1}{4}$	$1\frac{3}{4}$	Bare $\frac{3}{8}$	$1\frac{3}{4}$	—
[1] " Ribbon width " (mms. $\times 10^{-4}$)	154	194	202	215	191
[2] Weight per cm. of hair (mgs. $\times 10^{-5}$)	97	136	171	255	165
Hair break (grms.)	3·92	4·70	5·04	7·00	5·16

Tenacity ; Beaking strain : Length. Average 3·1 grms. per M. denier, or 31,000 M. Br.

[1] Note that " Ribbon width " is *not the diameter*, but is the major axis of the ellipsoid in cross section : the minor axis runs round about half of this.

[2] Hair weight per cm. is taken in the middle of the hair, and is subjected to a dubious correction for the whole length of the hair.

(The above data are from the Research Records of the Fine Cotton Spinners and D.A., Ltd., and were prepared by Dr. W. Lawrence Balls).

Some calculations from data of dimensions, etc., for wt/length. Single hair : average den. 2 Tenacity 2·0—3·5 grms. per den. (similar to boiled-off silk).

Taking the filament of cotton as a cylinder (mean diam. as indicated).

0·2 mgr. – 1 metre length = 0·315 mm.^{3}

Taking cotton substance at 1·53 sp. gr.

Vol. of 0·2 mgr.	0·130	40%
Air space	0·185	60%
Total	0·315	

For the Yarn :—

100's—diameter of thread (approx.)	0·1 mm.
Vol. per 10 metres	78·6 mm.^{3}
Weight per 10 metres	60·0 mgr.

The Vol. of Yarn Cylinder represents approximately :—

50% Cotton substance ; 50% Air space.

Apparent surface of Yarn Cylinder : Approximately 550 cm.^{2}

The figures for commercial production (1922) on the basis of 15 tons per week, are :—

100's Combed Doubling Weft : A weight of 33,600 lbs. per week would require 186,000 spindles, which at £4 a spindle for cost and working capital would equal £744,000 total cost.

The charges to be considered weekly in producing this weight would be :—

Cotton £3,800 ; Wages £1,290 ; Coal and Power £215/250 ; Interest on Capital (say 10%) £1,490.

Approx. cost 4/- lb.

60's Combed Doubling Weft : A weight of 33,600 lbs. per week would require 93,000 spindles, at a cost including capital of say £384,000. The weekly charges would be :—

Cotton £3,100 ; Wages £730 ; Coal £110/130 ; 10% of Capital £760.

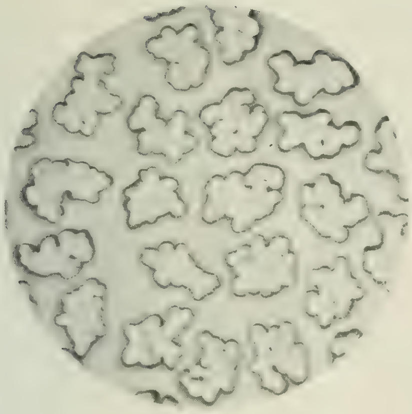
The hours run each week would be 48.

Approx. cost 2s. 9½d. per lb.

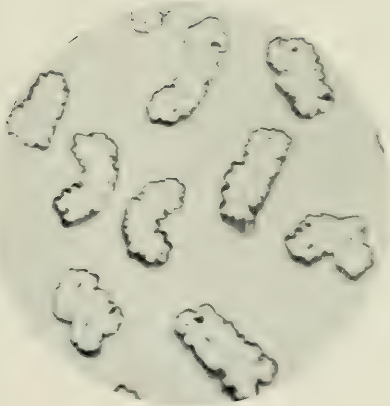
(These figures are from the statistical records of the Fine Cotton Spinners & D. A. Ltd.—H. Stowell.)

Paper, of substance 15 grms. per square metre, represents 666 cm^2 of paper surface per 1 grm. (of cotton cellulose) and obviously twice this of apparent web-surface.

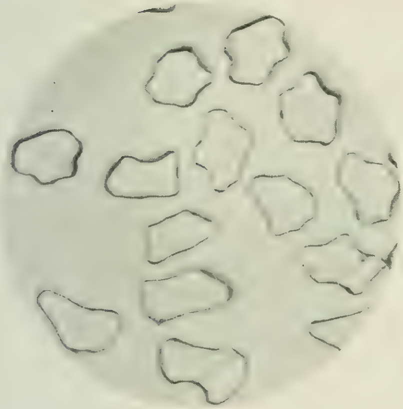
A " cigarette tissue " of this substance has an apparent gravity of 0·6 and, allowing for the vol./wt. of the mineral matter, the paper represents a web or tissue



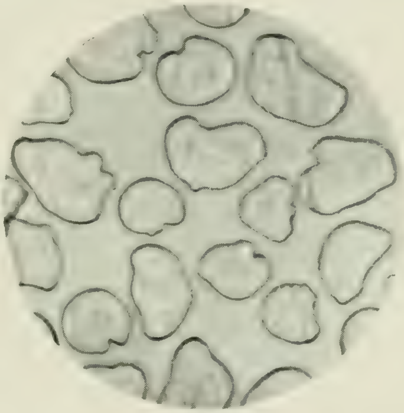
Modern Viscose Silk I.



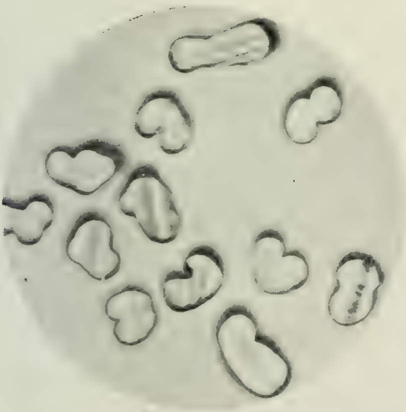
Modern Viscose Silk II.



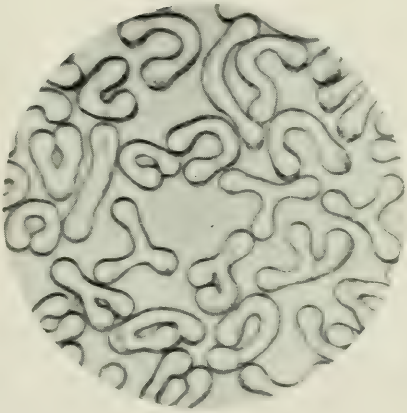
Viscose Silk, 1905.



Cuprammonium Silk.



Nitro-cellulose Silk.



Cellulose Acetate Silk.

of approximately 50% fibre substance (cellulose), 50% air space. This paper converted into a paper yarn by slitting, rolling to a cylinder, and twisting, would represent a yarn of 150 den. (metrical) per 1 mm. of width or original web.

Tissue Paper Manufacture: Fifteen tons per week of "substance" 15 grms. per square metre from cotton rag cellulose.

The cost for full Mill equipment works out to, say	£80,000		
To this would require to be added, say	£15,000		
For working capital, approximating three months' output, making a total capital of, say	£95,000		
With the raw materials (including chemicals for treatment) for one ton of finished paper costing	£53	17	6
Power costing	£5	0	0
Labour costing, say, per ton	£12	8	0
The total cost of raw material, power and labour, would be	£71	5	6
In addition to this, depreciation on the plant, exclusive of buildings at 7½% per annum = £4,750, which works out to, per ton	£6	6	8
Felts, oil, etc., per ton, say	£1	0	0
Approximately	£78	12	2
Add 10% interest on the capital invested, viz., £95,000, we get £9,500 which works out to, per ton	£12	13	4
	£91	5	6

Which works out to 9·8d. per lb.—a low figure for this quality of paper, for which the raw material costs £50 10s. 0d. per ton of finished paper, using new, unbleached cotton rags.

(The above figures are the approximate estimates of Messrs. Bertram's, Ltd., Edinburgh, a leading firm of paper makers' engineers and specialists.)

Viscose Artificial Silk and Filaments: Viscose, drawn from an orifice of 0·1 mm. and solidified, represents a volume (viscose) of 7·85 mm^3 per metre of length: and at 7—8% cellulose content, this conditions the average unit "fil" of 6—7 metric deniers, *i.e.*, without reduction of volume by drawing out or drawing down.

For a technical-scientific study of this problem refer to the recent publication of Dr. E. Bonnert, *Jl. Soc. Dyers and Colourists*, June, 1922.

The Viscose unit filament (cellulose) of approximately cylindrical form (as at date 1905) has a surface (length or lateral surface) of 930—950 cm^2 per 1 grm. of substance. Technical progress in changing the form of the filament (as demonstrated by photo-micrographs of sections) has increased this surface by 40—60%, with proportionate appreciation of textile quality (covering power, adhesion of filaments in warp yarns of high twist).

With this feature of progress, there is another of equal importance—the increase of specific tenacity (breaking weight) both dry and wet, from the 1·2—0·5 grms. of 1905 to 1·6—0·75 grms. per denier of the present-day product.

Factory Production: It would be interesting to complete the comparison of the three industrial treatments of Cellulose by statistics of the Artificial Silks parallel with those of Cotton Spinning and Paper Manufacture. The latter, as long established industries, are on the basis of open competitive costs and values. The Artificial Silk and Filaments are in a different position, not only in regard to the general conditions of economic production, but specially in regard to the particular changes of values fundamental to the industry, *i.e.*, of raw materials (including chemicals), labour, and power. Lastly, the capital charges involved are not comparable with those of long-established industries, and the costs of technical control and research are on a different scale.

The comparison can only be completed, and that approximately, by those who have the very special knowledge for laying out a factory construction, and capital scheme, embodying the results of the experience, positive and negative, of the 20 years of technical progress of the several systems and an estimate of the past and future of their competitive evolutionary struggle.

To return to the question of a critical estimate of the future of the industry in artificial filaments. In the developments of the last thirty years, the matter has passed out of the region of " pure " science : the world has adopted the products, and the present consumption is in excess of 100 tons a day. As to competition with and displacements of silk, this is less marked than creation of textile novelties, applications of the products *sui generis,* based on qualities and prices and the conventional estimates of value.

As a psychological point, the fateful term "Artificial Silk " from which there appears to be no escape—though a bar sinister, and a prejudice, has hardly been operative. It probably influences the superior shop assistant in advising customers that an article which tempts them is " only wood " ; and it is evident in inter-feminine conversations on wearing and other qualities of textiles.

To put the matter briefly : *La soie est parvenue, enfin arrivée, malgré soi*!

It is the depressing function of exact science to recognise certain fundamental facts which at first sight appear to confirm the prejudiced estimate of value. The three cellulose silks represent de-graded celluloses.

One hesitates to use the proper terms in these days of journalistic inexactitudes, for it will certainly be rendered " degraded," and even a specialist audience may not correctly evaluate its significance. But they will understand being referred to the Textbooks in respect of a definition of cellulose as a chemical individual and structural colloid, with regard to :—(*a*) The Natural Normal, (*b*) The Normal Pure or Bleached, and (*c*) The infinite number of de-grades, natural grades of inferior differentiation, and modifications determined by industrial treatment, generally with lowering of quality.

Perhaps it will be assumed as *a priori* evident that the prototypes of nature, such structural materials as silk and cotton, are the ideals of perfection whether estimated on the basis of convention or in the terms of exact science. Science certainly confirms the world's estimate of quality and value. Those of silk quality expressed in low specific weight, tenacity, elasticity, resistance to destructive influences, whether of atmosphere or of treatments incidental to preparation and use (chemical) or wear and tear (mechanical) are inimitable. Nor must we forget that it is also, a manufactured product, not an original or primary structural material Of Cotton, as a chemical individual (cellulose) and a structural colloid of highly specialised form, with properties and qualities similarly expressed in the exact terms of laboratory language, we can merely state that it is its own standard of super-excellence.

From these we descend to the now familiar " artificial " products. We note that it is only the familiar *form* which is artificial. To produce this, the cellulose in each case passes through a chemical cycle, but with resulting de-grading effects—that is, instead of a cycle, a cycloid, with the reverted or regenerated cellulose on another and lower plane defined in the essential terms of constitution or properties, this notwithstanding the fact that the cellulose may be recovered without loss. On this important aspect, it may be pointed out that each cycle has its special chemistry and danger points.

In the original nitro-cellulose process there are the two defects readily appreciated by chemists—the presence of sulphuric groups (SO_4H) in the ester product, and not wholly removed in the denitration treatment. This treatment is not a simple saponification of the nitrate, and it does not appear to be possible to effect the simple reversal in the case of the nitrates. The treatment with alkali for such purpose determines changes in the nitric residues, with destructive action on the cellulose complex. The process devised to avoid this is one of de-oxidation of the acid residues and combination with bases to soluble forms. But it is evident from the properties of the regenerated cellulose that it has been de-graded.

The cuprammonium solution of cellulose is extremely sensitive to the action of oxygen, and to light ; the cellulose complex in solution is de-graded and the change is evidenced by loss of viscosity of the solution. (Gibson, *Jl. Chem. Soc.,* 1918.)

The industrial process involving this phase obviously depends upon a controlled limitation of this down-grade change.

The viscose process is, to the chemist, a violent treatment of cellulose, but the severe treatment with caustic alkali determines changes which, if destructive in a limited sense, are compatible with the special characteristic of the cellulose in the xanthate or viscose phase, the property of spontaneously reverting to insoluble form. On reflection, chemists will recognise in this property an important factor of the technical progress of the industry from its earlier stages as set forth in our preceding notes. A further point to be noted is that the reverted cellulose, in its various forms of thread, film and solid, has been kept under observation for 20 years, and this evidence of permanence is unassailable.

In regard to the actual constitution of the cellulose in the three artificial modifications, no one appears to have undertaken a methodical investigation such as would afford a measure of the kind and degree of differentiation from the normal. Taking, as an integral measure, the tenacity of the artificial silks, we see that the inferiority to the natural prototype is large; so, also, the degree of resistance to water and generally to solutions of active hydrolytic agents, notably acids and alkalis.

Cotton, moreover, has the advantage of its form or structure, which conditions a number of effects not realisable with a structureless solid form of matter.

In contrast with the three forms of cellulose, the acetate, *i.e.*, the normal acetate, presents characteristics which it has been hoped to realise in a superior "artificial silk."

(1) It is of notably lower specific weight, and approximately that of the silkworm product.

(2) As an ester derivative, it has a resistance to water much greater than even the normal cellulose.

(3) As an ester, it represents a considerable increase of weight in relation to the parent substance or industrial raw material, whereas all forms of "cellulose" silk represent a lesser weight. And, moreover, the thread or silk once formed is in its saleable form, requiring only the mechanical treatments incidental to finish.

These are strong points of claim; but there is the other side.

The Acetate fulfilling the requirements of a spinning, *i.e.*, a drawing process, is a considerable departure from the normal. In regard to colloid-structural characterists, it is inferior to its analogue, the nitric ester; and the "silk" fails to show superiority to the "cellulose" silks in tenacity in the dry or wet state.

In regard to the important question of cost of production, it is difficult to estimate this on the present and prospective basis of industrial values. In the period 1900—1914, when acetic acid and anhydride were on the low level of selling values, it was possible to produce the cellulose in solution as acetate at approximately the cost of the viscose form. At this period of violently alternating industrial values, it is impossible to make a comparative estimate. Further, the process actually adopted involves the separation of the acetate from its original solution, and redissolving in organic solvents to the solution to be utilised in the process. The problem must, therefore, be left unresolved, and the issue to the factors of industrial evolution and survival.

In regard to present progress there is considerable achievement in the production of fine denier yarns—5 denier, 3 denier, even down to 2 denier. This no doubt arises from a certain positive competition with silk and a certain displacement of natural silk. Progress and evolution here is very much a matter of convention and demand based upon conventional estimate of textile quality.

The long future, I should point out, is certainly a matter of science. Our present knowledge of cellulose, which appears to be considerable, is in important respects superficial; actually, we have very little control of cellulose reaction, and the control we have is on proximate lines. We have no control of ultimate factors which may be of first importance. The outlook here involves research and systematic study of cellulose. We have endeavoured to give indications on broad lines upon which such problems are to be attacked and perhaps resolved in our Volume IV " Researches on Cellulose " (C. F. Cross and C. Dorée) just published.

Anything I should say on this matter would be a diffuse repetition of the matter of that volume, and I propose to leave this side of the problem with merely the indication of the directions in which research should contribute to progress—at first, progress of science, and, in due course, progress of industry. These main directions of more profound study of cellulose are the *via aspera* of physics and physiology.

As should have appeared from this present treatment of the subject matter, the incubation period in textile progress is a long one, and this may discourage workers other than those who are prepared to take the longest views of art and life. It is a consoling reflection that these long views are only the intellectual framework : the animating principle and experience of the research worker is that "Joy's soul lies in the doing."

The lecture was illustrated by exhibits of yarns, woven and knitted fabrics, specially selected in demonstration of technical progress, and contributed by Messrs. Courtaulds Limited and Société Française de la Viscose (viscose textiles) ; and The British Cellulose and Chemical Manufacturing Company, Ltd. (Textile, Films, and Solids, of Cellulose Acetate) ; also with photo-micrographs and technical data. To these firms, and on behalf of the Institute, I wish to record an expression of thanks, as also to the Fine Cotton Spinners' Association (Dr. W. L. Balls and Mr. Stowell) and Messrs. Bertrams Limited (Mr. S. Milne) for their contributions of technical matter.

DISCUSSION.

Mr. J. H. LESTER (Manchester), proposing a vote of thanks to the lecturer, said that not only was Mr. Cross the originator of the viscose process but the history of the constitution of cellulose had been a subject which he had made his own in association with Mr. Bevan. It was because he started out with an ideal above and beyond him that many industrial results had arisen. It was a case of the higher the ideals the more numerous the bye-products. The constitution of cellulose was still a matter for considerable argument and discussion. Possession of the complete knowledge would be the means of advancing industry, but even if the achievement were not complete there would be a return of reward on the way. Mr. Cross represented a type of individual to be brought along in greater number for the benefit of industry. To-day, the profession of textile technology hardly existed, but it had got to be recognised in the future and that was why the Textile Institute was anxious to secure a Royal Charter.

Professor A. J. TURNER (Manchester) seconded, and said that the Lecturer's generous offer that day to give advice and information indicated how it came about that Mr. Cross had been concerned in so much of important work in the past. His attitude had been a stimulus to other workers, and that stimulus had resulted in the enrichment of the pages of the works on cellulose by the lecturer. The developments in regard to artificial filaments in so short a time was astonishing. It was commonly said that there had not been great achievements in the textile industry during the last fifty years, with the exception of automatic looms, but it was often overlooked that mechanism was not the only concern of the industry. New raw material was a matter of the greatest moment. Jute was not yet 100 years old in its great commercial exploitation, whilst cotton was only about 150 years old so far as widspread commercial and special applications were concerned. A description had just been given of the introduction of the raw material for " artificial silk." He did not think there was any fear that the cotton industry would be displaced by the development of production of artificial fibres, but it must be remembered that this raw material was new and we had not yet seen the limits of its possibilities.

The vote was heartily accorded, and

The **Lecturer**, in response, said he had never for a moment suggested that the artificial would displace the natural fibres. Cotton was an extraordinary structure and there was not the slightest idea of approximating to it by artificial fibre. As to natural silk, it was so enormously superior in chemical structure that he had no expectations in that quarter. Artificial silk had not displaced silk to more than a fractional amount. "The great problem for the chemist," he added, "is: Can he carry out an up-grade process in the interior of the cotton substances in place of a de-grading process? I look to the young men of to-day to put energy into this problem and give us an undegraded product."

BLACKBURN AND DISTRICT COTTON EMPLOYERS' ASSOCIATION.

Following the delivery of the Mather Lecture, the visiting members were entertained to luncheon, in the King George's Hall, by the above-named Association. Mr. James Smith, as Chairman of the Association, presided over the assembly and representatives of many phases of municipal, commercial, and industrial life in Blackburn were present.

The toast of "Our Guests" was proposed by the Chairman, who said that as to the future of the cotton trade he supposed the optimists would be correct some day, but, for the moment, he, at any rate, felt none too sanguine. It behoved them to encourage all forms of education leading to developments of the technical and scientific aspects of the industry. He believed they would have to look more and more to organisations like the Textile Institute, research associations and technical colleges, for that assistance which the problems of the industry demanded.

The **President of the Institute** responded and thanked the Chairman for the hospitality so generously accorded by the Cotton Employers' Association. It seemed to him, he said, that in the matter of trade this country must produce articles which the world requires at prices the world can pay. India had begun to impose a tariff against Lancashire goods. If India produced the coarser goods then this country would have to endeavour to produce that which India would be obliged to take in spite of the duties. Bradford had been in a somewhat similar position with reference to America. The textile industries in this country must keep on progressing and all the help which could be got from the scientist must be taken advantage of. This country had gone through a big crisis, but it had weathered it better than many other countries. He was hopeful that greater interest would be taken in the Textile Institute as an organisation embracing all sections of the industry and bringing the various interests into closer contact and relationship. The Institute hoped to succeed in an application for a Royal Charter so that it could set up recognised qualifications or degrees and in this way something definite could be done for the benefit of the whole industry.

Mr. **John Crompton**, Chairman of Council of the Institute, also responded and complimented Blackburn on the rapid advances made at the local Technical College. He looked upon that institution as a pioneer in respect of technical education, particularly on the textile side. He was delighted to know that the trade unions were in full sympathy with the work and that it was practically a condition that entry to the position of overlooker involved attendance, as apprentices, at the textile classes. The Textile Institute would like to see a large accession of members from the Blackburn district and he desired to take that opportunity of saying that they had no interest to serve beyond that of the well-being of the textile industry generally.

Mr. **Fred Hargreaves** also spoke and referred to the present state of trade. A more normal condition of trade could only be expected when goods were produced at a price which customers could afford to pay. Industrial harmony was essential to industrial prosperity. It was necessary that commercial intercourse should be fully restored, with confidence that business obligations would be fully respected so that the industry in which so much capital was invested and so many workpeople employed might be preserved and extended. This could only be effected by the closest co-operation on the part of all sections of the industry and allied trades, and it was therefore with much pleasure that he bore testimony to the importance of the work being carried on by the Textile Institute, and he wished the greatest possible success for the institution. He had every confidence that by co-operation of effort existing difficulties would be overcome. It had been suggested that the bankers had not done all they might have done of late, but, as a chartered accountant with special knowledge of the facilities given, he could not in the least degree agree with the suggestion.

Mr. J. Johnson (secretary to the Blackburn Operative Spinners' Association) also responded and claimed that this country possessed the finest workpeople in the world. The aim should be to advance the quality of their productions along with the advancing skill of the workers.

A hearty vote of thanks to the Chairman and the Cotton Employers' Association concluded this part of the proceedings.

Subsequently, the visitors motored to Daisyfield and inspected the works of the British Northrop Loom Co., Ltd. The inspection was carried out under the personal direction of the Manager (Mr. D. M. Hollins). The party was formed into groups and conducted over the various departments, the inspection occupying practically the whole afternoon and exciting the keenest interest on the part of the visitors.

In the evening, several members attended a lecture under the auspices of the Blackburn Textile Society, when Dr. A. W. Crossley, Director of Research at the Shirley Institute of the British Research Association for the Cotton Industry, gave an account of the Shirley Institute and its work, whilst Dr. A. E. Oxley described a research for which he had been responsible at the Institute.

NOTES AND NOTICES

A LONDON SECTION OF THE INSTITUTE.

The oft-repeated suggestion in favour of the formation of a London Section of our Institute has this year come forward again in a manner which gives promise of the establishment of a really useful organisation. Sir Frank Warner, K.B.E., the esteemed Past President of the Institute, has entered into the movement with characteristic energy, and, after the formation of the Section by existing members in the Metropolitan area—a meeting for this purpose having been called for the 13th November, at the hall of the Clothworkers' Company, kindly granted for the occasion—there is to be a further meeting, on a larger scale, with a view to the launching of the Section's work and enlisting widespread interest in it. Proposals as to activities have already received substantial consideration, both in London and at the Institute in Manchester, and there appears to be every reason for the assumption that the movement will be successful.

DESIGN AND STRUCTURE OF WOVEN FABRICS.

The Committee of the Institute which carries out the work connected with the annual competition under the Crompton Prize Fund Scheme, has this year experienced an arduous task in the matter of adjudication, notwithstanding the fact that the number of competitors is rather less than was the case in the previous year. The competition has demanded several meetings and the devotion of a great amount of time to consideration of the merits of the competitive albums of specimens. At time of writing this note, the date for the presentation of the prizes has not been definitely fixed, though the event will doubtless take place on a Saturday afternoon late in the present month or the early part of December. The specimen albums issued annually by the Institute to the various subscribing technical institutions are now in preparation and will be issued shortly. This year, more than average difficulty has been experienced in compiling these albums. It is in the natural order of things that in each succeeding year the selection imposes more and more effort on the part of those responsible for the collection, as repetition has to be avoided. The institutions possessed of the complete series, however, secure an increasingly useful collection of samples of woven fabrics as the years advance. Not only are the specimens of somewhat special interest, but the respective issues provide a valuable record of the class of materials available on the retail market in the different years covered.

RETAIL TRADE "BAROMETERS."

When trade is more or less generally associated with " slump " conditions, the keener is the alertness of all concerned for the appearance of any sign which may possibly be regarded as pointing to a turn of the tide. A correspondent calls attention to a recent statement in " The Textile World " to the effect that improving conditions in the sales of carpets by auction provide " a barometer of clearing skies in the commercial field! " The reference does not appear to offer any suggestion as to the reliability or otherwise of this remarkable barometer. The suggestion presented, however, does appear to open up a fairly big field for enterprise on the part of individuals who claim to be specially well-informed, and even gifted in the prophetic sense, with regard to the " swing of the pendulum " in the matter of trade. Some day, perhaps, phenomena which are supposed to point the way of trade may be tabulated in order of importance and tendencies indicated by them may be broadcasted after the manner of weather-forecasting. It is conceivable, however, that study of these trade barometric readings might, in some cases, prove so overwhelmingly engrossing that some measure of the elusive trade would be lost in the process. Our correspondent adds another " barometer," in calling attention to the one already described. It is asserted that the measure of the sales of the twine manufacturer forms the best indicator of activity in retail trading, and the suggestion is added that the whole subject involved might well be investigated by the economists. The economists deserve great sympathy.

INFORMATION INQUIRIES.

Inquiries and effort to secure adequate and useful information thereon demand a good deal of attention on the part of the Institute staff. In a large number of cases, members of the Institute concede valuable assistance in this connection. An inquiry at present in hand refers to the manufacture of cotton powder for plastic compounds, the correspondent desiring to get into touch with a firm who would be interested in a process for the manufacture of the powder, for which, it is stated, there is an immediate market. The correspondent states that the raw material required is short fibre waste. Another correspondent desires information as to a fibre described as " Ghazi."

NEW PUBLICATIONS ON DESIGN.

Impending publication of a number of novel and interesting works on textile design is announced by Messrs. B. T. Batsford, Ltd. (London). The first of Mr. W. G. Paulson Townsend's Series of five volumes on " Modern Decorative Art in England " is devoted to illustrations from the time of William Morris to the present day of Woven and Printed Fabrics, Wallpapers, Embroidery, Lace, Tapestry, Batik, and Stencil Work. A concise but comprehensive manual on " Historic Textile Fabrics," by Mr. Richard Glazier, Hon. A.R.C.A., late headmaster of the Manchester School of Art, will add materially to that author's contributions to literature.

In addition will be issued a series of plates showing textile treatment of various flowers in Oriental and European work, under the title of " Floral Forms in Historic Design." The drawings of these have been prepared by Mr. Lindsay P. Butterfield, the well-known designer, and Mr. W. G. Paulson Townsend contributes the Introduction and Notes. The same publishers announce an English edition, condensed into one volume, of Otto Von Falke's great work on "A History of Design in Silk Fabrics " with 10 plates in colour and 500 specimens of all periods and countries. At the same time, an issue is taking place in England of three uniform volumes, with plates in colour by a special artistic facsimile process, of Chinese Embroideries and Textile Fabrics; Coptic Textiles, Tapestries and Embroidery; Peasant Art in Czecho-Slovakia, each containing about 40 plates and illustrating about 100 typical designs.

REVIEWS

Color Index. Published by the Society of Dyers and Colorists, 38, Wall Street, Bradford. Edited by Dr. F. M. Rowe.

Those who know the difficulties surrounding the preparation of so complicated a work of reference must pay a tribute to the courage and enterprise shown by the Society of Dyers and Colorists. The object of the compilation is, in the words of its editor, " to produce as accurate and comprehensive a work as possible dealing in tabular form with all dyes of known constitution which have received commercial names "—in other words, an English work to take the place of " Schulz " and to improve upon it.

The Society knows something of the art of publicity. The index has been loudly heralded in the daily Press—so loudly that we have awaited the first number with considerable interest to see what form it would take. Let us say at once that the Color Index Committee has done its work well. The form of tabulation, with one unimportant reservation, could hardly be improved upon. The headings under which the information is grouped are :—(1) Commercial Name; (2) Scientific Name, Components, Formula; (3) Preparation; (4) Discoverer, Literature; (5) Description, Properties, Mode of Application. Ample space is allowed for individual notes.

The order in which the dyestuffs are tabulated conforms to well known lines. Part I includes the Nitroso, Nitro, and a number of the Monazo coloring matters following each other in chemical sequence.

It is clearly impossible to review a work on the strength of Part I, all of which deals necessarily with the simplest of synthetic dyestuffs, but, whilst the editor is probably right that in order to make the work complete it is desirable to include some dyes now of historical or scientific interest only, it is surely unnecessary to include in detail so many obsolete coloring matters. Too many dyestuffs enumerated in this issue might come with advantage within the scope of the editor's remarks that " in certain cases types of groups of dyes are described rather than individual products." Three Chrysoidines, for instance, are detailed and again three Cochineal Scarlets made respectively from aniline, toluidine, and xylidine, occupy three separate places in the tables.

It is not yet quite clear what form the preparation column is finally going to take. Some of the processes described so far are perhaps too elementary. Much of the information given for the preparation of quite ordinary organic compounds, process for simple sulphonation, acetylation, etc., can be obtained elsewhere in quite trustworthy form.

The inclusion of a set of fastness tables the better to illustrate a dyestuff's properties is an excellent system. The tables are adequate with the exception of the standard-to-light which might be stiffened in accordance with more recent German practice. So far, they have been applied only spasmodically—a fact which may be accounted for by the number of dyestuffs dealt with in Part I which are rarely used. Such notes on dyestuff behaviour which belong more properly to a description of the color than to a textbook on dyeing are of the utmost importance not only to the user but also to the manufacturer and the student. It will be interesting to see how this question is treated when the index deals with more modern dyestuffs the properties of which have been searchingly tested and tabulated by the manufacturers.

The index deals capably with the dyestuff's appearance, solution, behaviour towards the usual reagents, and, in many cases, gives the spectrum in water. References to the literature on the subject appear to have been very carefully assembled and verified whilst for further information on the technical side of a color's application, the reader is freely referred to that excellent "Manual of Dyeing" by Knecht, Rawson, and Loewenthal.

Where we have criticised, it has not been so much in the spirit of criticism as in the desire to see this English work well ahead of its foreign predecessors and, above all, moving with the times. It is not wise to overload a modern color index with colors of the past. Within that definition come many which achieved a temporary war-time prominence.

We intend to refer to the work again at a later date when some further numbers will have appeared. —C. S. P.

RESEARCHES ON CELLULOSE (1910-1921)—IV. By C. F. Cross and C. Dorée. (Longmans, Green & Co. 15/- net.)

In the introduction to this valuable book the authors mention the recent developments in research relating to the textile industry, and refer to the Textile Institute, the Cotton Research Association, and the Fine Cotton Spinners' Association. A selection of a few names by eminent experts unavoidably gives an impression to the lay reader that research is limited to the institutions mentioned. Quite a number of trade associations and companies are carrying out research to-day, some of them having done so for quite a long time.

In Chapter 1, a general account is given of developments, particularly on the questions of constitution, due emphasis being laid on the fact that the graphic formulæ already proposed are quite insufficient to explain the properties of cellulose as found in nature. Chapter 2 deals with the physical properties of cellulose, the importance of which is gradually being realised by those engaged in industry. Recent work on the internal stresses in cotton, the presence of growth rings in natural cotton fibres, and the modifications in properties produced by mechanical disintegration is described. It is pleasing to note that a paper on surface films finds its place in a book of this kind, illustrating fully the growing importance of physics—a subject sadly neglected by chemists preparing for service in the great textile industries of this country. Recent investigations on the fluorescence of cellulose and on the solubility of cellulose in solutions of inorganic salts are described in detail. The crystalline structure of cellulose as determined by X-ray analysis is mentioned.

Chapter 3 deals with the chemistry of cellulose and gives an account of most of the recent work on the hydrolysis of cellulose and its methylation products. The more recent constitutional formulæ of Hess, Hibbert, Irvine, and others, are discussed, due criticism being made of their disadvantages.

In Chapter 4, the remarkable effects produced in cotton by partial xanthogenation are fully described. Chapter 5 deals with oxycellulose and hydrocellulose, and gives an account of the recent work on the subject. The authors arrive at the conclusion that there is no distinct line of demarcation between oxycellulose and hydrocellulose, and might with advantage have included cellulose itself in the remarks.

An account of most of the recent work of lignocelluloses, a subject which seems as complex if not more so than that of cellulose itself, appears in Chapter 6, whilst Chapter 7 relates to cellulose industries and technology, and forms a valuable and interesting section. The importance of the questions discussed in Chapter 4 to the paper-making industry is indicated. The properties of arghan and kapok are mentioned, and an account is given of the effect of sea water, of storage, and of bacteria on cellulosic fibres.

The book concludes with remarks on the narrow and empirical basis on which most of the technical literature on cellulose exists, without discussing the causes of this defect or its remedies. A deeper study of physics will do much to meet this criticism.

The book would have gained considerably in value if artificial silk had been included. There is much literature available on this subject which might have been described. It is hoped that this will not be neglected in the next volume, which chemists will expect.

The book should be in the hands of all interested in the chemistry, physics, and technology of cellulose, and textile men generally would do well to find a prominent place for it on their bookshelves, and to read it systematically. —W. HARRISON.

Dyes Classified as Intermediates. By R. Norris Shreve, in collaboration with W. N. Watson and A. R. Willis. (Chemical Catalogue Company, Inc., New York, 1922. Price $10.00 net.)

This book is designed to fill the rôle of a work of reference to which those dealing with both intermediates and dyestuffs can profitably turn, since it shows in tabular form the commercial dyes which are manufactured from each important intermediate. The book may therefore be said to be complementary to Lange's "Zwischen Produkte," and is likely to prove useful to chemical manufacturers owing to the fact that it is a work from which suggestions can be obtained as to the best possible methods of utilizing their intermediate products.

The arrangement of names is alphabetical. Under each principal name is given the synonyme (both being cross-indexed in their alphabetical order) the empirical and structural formulæ, molecular weigh, a very brief description of the methods of formation, and the principal literature references, which latter, although quite up to date, could with advantage be amplified in future editions.

Included in the book is also a formula index and an alphabetical list of the names of dyes referring to their Schultz Numbers, which greatly facilitate the work of those seeking information.

The work represents an immense amount of well-directed labour.

T. K. WALKER.

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PROCEEDINGS

DESIGN AND STRUCTURE OF WOVEN FABRICS.
TEXTILE INSTITUTE CROMPTON SCHEME AWARDS FOR 1921-22.

The adjudication in regard to the annual competition for advanced students at technical institutions, under which the Textile Institute, by means of the Lieut. Crompton Memorial Fund, offers £100 in prizes annually in respect of the design and structure of specimens of woven fabrics, has been completed and the awards made as follows:—

First Prize (£35) and Parchment Certificate: George A. Bennett, Farnworth (Manchester College of Technology).

Second Prize (£25) and Parchment Certificate: J. C. Woodhead, Nelson (Nelson Technical School).

Third Prize (£15) and Parchment Certificate: Robt. H. Wright, Nelson (Manchester College of Technology).

Five Awards of £5 each: Hiram Hartley, Leeds (Bradford Technical College); Wilfred Stancombe, Burnley (Nelson Technical School); Francis Smith, Blackburn (Blackburn Technical College); G. A. Frankland, Nelson (Nelson Technical School); Edgar Robinson, Bradford (Bradford Technical College).

In a report on the competition, the Adjudicating Committee acknowledge valuable advisory assistance on the part of representatives of large retail concerns in the matter of assessing the commercial value of the specimens of competitors. The competition, as compared with the two previous years, has revealed definite advance in the standard of the work of the competitors. More effort has been made to combine qualities of structure, colour, and ornamentation, admitting of simple expression and of the production of cloths of a really commercial character. Full advantage has been taken of possibilities in the use of fancy yarns, whilst adaptation of cloth structure to finish has been kept well in mind. Several of the albums of specimens are extremely interesting from the point of view of the exercise of restraint in design, colour, and general presentation.

The presentation of the prizes, in accordance with the foregoing awards, took place at the Institute, Manchester, on the afternoon of Saturday, the 2nd December, when Principal Mouat Jones, of the Manchester College of Technology, attended and distributed the prizes on behalf of the Institute Committee which has charge of the competition.

Mr. E. T. HOLDSWORTH (Bradford) as Vice-Chairman of the Council of the Institute, occupied the chair, and welcomed Principal Jones, expressing appreciation of his interest, shown by his ready acceptance of the Committee's invitation, in the work represented by the Crompton Competition. The Chairman further mentioned that the competition had only just completed its third year of operation, and the Committee in charge of the scheme had, from time to time, as experience suggested, introduced modifications in the competition conditions. The conditions for 1922-23 contained some important modifications, so that intending competitors would be well advised to study the conditions closely. At the same time, he was asked to announce that the Crompton Prize Fund Committee would always be pleased to give full consideration to suggestions submitted on the part of those interested.

Principal **Mouat Jones**, before handing over the prizes, offered hearty congratulations to the successful competitors. He said he knew something of the hard work, time and energy and skill which competitors had to display if they were to succeed, and the prize winners deserved the warmest felicitations. He congratulated the Institute on the valuable work being done by the conducting of the competition and also Mr. Crompton on the success of the scheme he had so generously endowed. It appeared to him that the scheme was fulfilling a most valuable function in fostering a more intimate connection between industry and technical education. Without question, the closer the contact the better the interests of industry and education would be served, and this scheme appeared to him to strengthen the bonds in those places most required. There were three main spheres of activity in which the textile industry hoped to call upon education—the scientific and mechanical, commercial, and artistic. Through the various research institutions, contact between industry and science was now very close; and the faculties of commerce of our universities were providing for the commercial side; but the problem of provision for development in design was a more difficult matter, art being of a more elusive and indeterminate character. He believed this Crompton scheme was doing a great deal to further the relationship between higher education and textile art, and, as years advanced, valuable results should accrue. Modern competition was demanding not merely cheaper production, but that more attention should be given to the æsthetic side, the consumer requiring goods not only cheap and useful, but pleasing and satisfying. He thought it was within the power of the manufacturers, by gradually raising artistic quality, to educate public opinion, and raise the level of the public artistic sense. In the long run, the big markets would be for those who did more than keep abreast of public taste, and who kept in advance of it and moulded it. Industry must be prepared to enlist the services of highly-trained specialists with creative instinct towards artistic design. Reverting, finally, to the Crompton scheme, he said it not only inspired the student and teacher to higher effort, but produced greater co-operation in the matter of structure and design. The fact that the Manchester College had got the first prize on all occasions indicated that they had not been slow to take advantage of the scheme, and he was inclined to express the hope that some other college would, in the near future, spoil their record. At any rate, he sincerely hoped the competition would become wider and keener every year, and that the best men would continue to win.

After the prizes had been presented, Mr. W. **Myers** moved a vote of thanks to Principal Jones, and said the competition was one of the best things that had emanated from the Institute. He believed there was a great future for it.

Principal **Richardson** (Bradford Technical College) seconded, and the vote was carried, a similar vote being warmly accorded to the Chairman, on the motion of Col. F. R. **McConnel**.

LANCASHIRE SECTION

Meeting at Institute, Manchester, 31st October, 1922, Mr. W. Myers in the Chair.

EMPIRE COTTON SUPPLIES.

By W. H. Himbury

(General Manager, British Cotton Growing Association).

Much interest is being manifested at this time in the vital question of the adequate supply of cotton for the world's requirements. Prior to the war, when the spindles of the world were working full time, there was a shortage of many thousands of bales, and the shortage was increasing annually. There is not the slightest doubt that, with conditions once more settled, and the world's spindles again running, this shortage will become most acute. Therefore, as I see it, the question of securing adequate supplies of the raw material is an increasingly vital one, not only for Lancashire but for the whole world, because we have not only to glance at things from the position to-day, but to look ahead. I feel convinced that the present phase of bad trade will pass away. After all, cotton textiles provide one of the cheapest forms of clothing, and there are millions of people in the world requiring cheap clothing. Provided we have ample supplies of the raw material, at reasonable prices, there is little doubt as to the future of the industry

The outstanding fact is that America is not producing anything like the quantity she used to. The crop from the States for the year ended July 31st, 1922, is put down by some authorities at approximately 8,375,000 bales, as compared with about 13,669,975 bales for 1920-21, and the prospects for the current season do not seem to be anything more than ten million bales, which, on the acreage grown, is little more than one bale to four acres. This is a matter that requires the closest attention of every hard-thinking man in the cotton trade, for we are faced with the fact that there is not likely to be an appreciable increase in the quantity of American cotton to come forward in the near future, and the growing insufficiency of the supply of cotton is a world problem as well as a special danger to Lancashire America continues to use more and more of her own supplies. Her consumption this year is likely to be between six and seven million bales. The most dangerous menace which the crop has to face in America is the boll-weevil pest, which in 1921 broke all records in its damage to the crop. In the weekly publication of the United States Department of Agriculture called "Weather Crops and Markets," under date August 26th last, I was rather alarmed to read the following :—

> The production of 6,277,000 bales of cotton, in addition to the seed that would have been ginned from that amount, was prevented by the boll-weevil in 1921, according to the computations made by the U.S. Department of Agriculture from estimates furnished by many thousand crop reporters. This damage to the potential 1921 cotton crop exceeded that of any former year notwithstanding the relatively small acreage planted to cotton that year. In fact, the boll-weevil damage in 1921 represented an increase of 37% over the damage to the 1920 crop, when the boll-weevil prevented the production of 4,595,000 bales.

The boll-weevil reduces production and adds to its cost. This season the lowest average cost was at Alabama, 17 cents., and at Georgia, 27. No complete remedy has yet been discovered, although various attempts, some partially successful, have been made to keep it down. The boll-weevil also inflicts a special injury on the longer staples, because where this pest is prevalent the tendency is to plant only early maturing cotton, which is short and generally unsuitable for fine counts.

With regard to Egyptian cotton, we are also on the lower side in production in quantity, and there is the tendency towards a decline in quality. Egyptian cotton fills a place in the British industry which American cotton cannot occupy.

The decline in cotton production in Egypt is a subject which has received the constant attention of industrial and economic critics for several years. The Egyptian crop before the war had reached a total of over 7½ million kantars. During the war, it fell to below five million kantars, and to-day the position is not regarded as at all satisfactory. Prior to 1909, when the failure in the Egyptian crop came about, it had developed steadily; since then, however, the downward tendency in the average yield has continued with fluctuations. For 1921-22, the crop was only 3,300,000 kantars with an average yield per feddan of 2·55 kantars from an area of 1,291,878 feddans, as compared with a crop of 6,035,504 kantars with an average yield per feddan of 3·30 kantars from an area of 1,827,868 feddans in 1921. The average yield per feddan for the seasons 1894-5 to 1913-14 was 4·61 kantars over an average area of 1,422,000 feddans, and the total average crop 6,433,000 kantars. It will thus be seen that the large increase of acreage due to an extension of irrigation facilities has been largely set off by the reduced yields per acre and it is clear that the maximum crops of pre-war years are not likely to be equalled again in the near future.

The factors influencing the yield per acre might be put down to several causes, but, principally, they are :—(1) the degeneration of the productive powers of the soil due to many reasons; (2) the ravages of insect pests; and (3) political disturbances. All these reasons have undoubtedly affected the crop, but one of the chief menaces is the pink boll-worm.

During the war, vast and necessary schemes for drainage, irrigation, and reclamation of land, had to be suspended, and, pending completion of these, it will be impossible to get increased water supplies to add largely to the cultivable acreage of the Northern Delta, which could be increased by a vast area of new land, much of which would be occupied in producing the best kind of Egyptian cotton. Various attempts have also been made to restrict the depredations of the pink boll-worm, one of the worst and most destructive of pests, but up to now no absolutely efficacious remedy seems to have been found.

During 1919, a Cotton Research Board was created. It is composed of selected scientists from various services of the Egyptian Government. The functions of the Board are to advise the technical sections of the Ministry of Agriculture, to co-ordinate scientific experiments, and, in general, to ensure the maintenance and improvement of the quality and quantity of Egyptian cotton. Extensive laboratories have been constructed and many experiments started, and it is hoped that the new organisation will devote to the problem of improving Egyptian cotton the closest attention which the importance of the subject demands. In view, therefore, of the 'great importance of the supply of fine cotton, those of us who are working for the development of increased supplies urge that no measures should be neglected and no expenditure spared until the Egyptian crop not only returns to its pre-war dimensions as regards yield, but makes some considerable increase.

I think you will all agree that this is a very grave position, and one which I am afraid many men in Lancashire hardly appreciate; but it will be quite clear to you all that it is becoming more and more desirable that Lancashire and the world generally should look elsewhere than to America and Egypt for supplies of cotton. Probably few people realise that even at the present time something like 5¾ million bales are produced every year in the British Empire, of which, of course, India contributes the lion's share; the balance is grown in our various tropical colonies and dependencies. In this connection, so far as area and population are concerned, the Empire ought to be able to produce all the cotton that Lancashire requires, and also a fair surplus for other countries. This brings me to the formation of that body which, twenty years ago, a few far-sighted Lancashire men brought into existence, and I think a brief account of the work which has been carried out by the British Cotton Growing Association over that period will best enable you to decide whether the Empire can provide the cotton we need to maintain and develop this great industry.

I will first of all deal with Africa, upon which the Association's main energies have been expended, and in which lie their most sanguine hopes for the future. In the first instance, in 1902 American experts were engaged and sent out to Africa, and attempts made in Gambia, Sierra Leone, Gold Coast, Nigeria, etc., but with the exception of Nigeria the attempts were not successful and I will therefore commence with Nigeria.

NIGERIA.—The Colony and Protectorate of Nigeria is situate on the Northern shores of the Gulf of Guinea. The area of Nigeria is roughly 335,700 square miles, and it is thus larger than any British Dependency other than Tanganyika, India, and the self-governing Dominions. It is nearly three times the size of the United Kingdom. Since peace was declared, a small portion of the late German Colony of the Cameroons (31,150 square miles) has for the purpose of administration been placed under the Nigerian Government. The population of Nigeria is approximately 17 millions, which is larger than that of any British Dependency except India. The main political divisions of Nigeria are the old colony of Lagos and two groups of Provinces known as the Southern and Northern Provinces, which together form the Protectorate.

The people are good farmers, the land is closely and well cultivated, and the growing of cotton has been practised for many years, and the cotton spun and made into clothing for several millions of people.

I well remember in 1904 being asked by Mr. J. Arthur Hutton, who was then the Chairman of the Council of the Association, to go out to Nigeria and report on the prospects for cotton in that territory, and I might say now that Mr. Hutton has rendered eminent service to the cause of cotton-growing, and his name will always be associated with this work. At the final interview prior to leaving England, I was astonished at the energy and enthusiasm displayed. I knew my Africa and its inhabitants probably better than most men, having travelled very extensively on foot through the whole of British West Africa before, of course, the advent of the railways, and I knew that the proposals before me bristled with climatic, transport, economic, and other difficulties. There were some initial failures, because the work of the Association was not only to prove where cotton could be grown but also where it could not be grown. At first, plantations were started with American overseers. These were not successful, and the Council of the Association very soon found that the best policy was to encourage the growing of cotton as a native industry. I might state here that the African does not indigenously work on plantations as a hireling; somewhat unconsciously, he has absorbed the white man's characteristic of a liberty-loving subject. The country is also rich in forest products such as palm-oil, kernels, rubber, timber, etc., so that he can always procure a natural and unaided living. At the same time, there are many who become keen on self-determination and, failing congenial employment in their home districts, they flock to the coast towns. A similar process takes place in Europe. Then, again, the land question is also a very important one. In Nigeria, and, in fact, in West Africa generally, the land is held in trust by the chiefs for the people, and the individual can only lay claim to the site of his father's house. He is, however, allowed as much land as he can cultivate, and, in those districts where there is a surplus after all the legitimate claims are granted, the land may be leased to the stranger. These labour and land difficulties combined with the fact that Nigeria is not altogether a white man's country, eventually compelled the Council to devote its main energies to the establishment of cotton-growing as a native industry. Therefore, for the present at any rate, plantations owned and managed by Europeans may be ruled out. This does not, however, prevent the establishment of small experimental plantations under the direction of the Agricultural Department.

The amount of cotton purchased and exported during the season 1920-21 constituted a record, the total amounting to 31,500 bales (of 400 lbs.), as compared with 16,200 bales in the previous year; 17,500 bales in 1919; and 6,200 bales in 1918. The seed is provided gratuitously to the growers, a market is guaranteed, the highest possible price is paid for the seed-cotton, and it is ginned, baled, and shipped home by the Association.

All the ginning is in the hands of the Association, but the buying is done by the merchants for a commission. There is no doubt that the West African merchants have shown an Imperial spirit in the way they have worked with the Association, and any success achieved is largely due to their broad-minded action.

Four large up-to-date pneumatic ginneries have been erected along the railway between Lagos and Kano, and these centres, with their numerous go-downs, staff quarters, etc., give the place the appearance of a hive of industry.

In recent years, very determined efforts have been made by the local Department of Agriculture, in co-operation with the Association, to improve the cotton coming from Nigeria, and the Agricultural Department of the Northern Province has successfully established the American long-stapled variety, known as Allen's. In 1914, the production of this variety totalled 11 bales, and it has been well taken up by the natives, who have received a better price for it, with the result that last year over 6,800 bales were produced, and this year about 10,000 will be marketed. This improved cotton of the Northern area is of very good quality, distinctly superior to the bulk of the American Crop; and, what is of more importance to the local growers, is the fact that the price of a superior cotton like this is never likely to depreciate to such a relatively great extent as in the case of the low-grade native cotton of the southern area.

Anyhow, it is proved beyond all doubt that American cotton has found a definite place in the agriculture of considerable areas of Northern Nigeria, and it is safe now to predict steady progress, proportional to the increase of transport facilities, the spread of the activities of the Agricultural Department, and the general progress of the country on modern economic lines.

The staple of Nigerian cotton ranges from $1\frac{1}{16}''$ to good $1\frac{1}{8}''$, and it is used for mixing with American or other growths, whilst some of it is suitable for users of Northern Georgias or short Memphis cotton.

Attempts to grow exotic cotton in the Southern Provinces, which might be termed the palm-oil belt, have not met with any substantial success. What is wanted at present, however, is strict control of seed distribution, measures to prevent contamination of the seed by inter-crossing with native varieties, and also some supervision when the picking is being done. Finally, the possibilities are great, but, in order to get a more satisfactory quantity of cotton grown, the railways and roads must be extended and a larger and better equipped agricultural staff installed. I see no reason why, at some future date, Nigeria should not give us at least 1,000,000 bales.

SUDAN.—I will now pass to the Sudan about which we have heard so much lately. Now the Sudan has a total area of 1,014,600 square miles. Its geographical area is larger than that of Egypt, and it is about half as large again in extent as the American Cotton Belt, or about the same size as Europe minus Russia. The Sudan is quite a new field for cotton growing, but it is capable of tremendous possibilities; in fact, its potentialities for the growing of long-stapled cotton are about the best we have. At present, the production is about 40,000 bales of good Egyptian Sakel. It is in the Gezira District, a large plain situated between the two Niles immediately South of Khartoum, that the best cotton has been produced, and with the construction of proper irrigation works very big things are expected, for the importance of the Sudan to this country lies in the fact that, so far as we can see at present, no other part of the Empire can produce large additional quantities of cotton of the Egyptian type.

The British Cotton Growing Association has always taken a keen interest in the development of the Sudan, and was instrumental in helping to get His Majesty's Government to guarantee the interest on the first loan of three million sterling for the construction of the Dam on the Blue Nile, capable of supplying water to irrigate 300,000 acres of which 100,000 acres would be under cotton. A start was made with these works, but, unfortunately, it was found that the construction was costing a great deal more money than the estimates provided for, owing to the general rise in the cost of labour and raw materials due to the war, and at one time there was some risk of delay in carrying out the full scheme owing to the difficulties encountered by the authorities in making the necessary financial arrangements to meet the increased cost of construction. The Association, through its President, exerted every effort to avoid this calamity, and a tentative arrangement was agreed to by the Treasury enabling the work of the scheme to be continued for another season, pending further examination of the revised estimates of cost, and as you will have seen from the papers recently the vast new scheme of irrigation has been finally approved and contracts have been placed for the work.

The scheme for cotton growing in the Sudan was initiated by the late Lord Kitchener, and it might be termed a socialistic scheme, for it ensures that the native who does the bulk of the work receives a fair reward for his labour. This, unfortunately, is not always the case in many parts of the world. The scheme is briefly as follows:—The cotton is grown on farms which have been established by the Sudan Plantations Syndicate at Tayiba, Barakat, and Hosh, of about 6,000 acres each, and a further farm of 10,000 acres is being opened at Wad el Naw. These four plantations, or units, will eventually form part of a whole scheme. The proceeds of the cotton crop are "pooled" and the native who does the cultivation receives 40%; the Government, which supplies the land and the water, gets 35%; and the Syndicate, which undertakes the entire management, does the minor canalisation, ploughs the land and gives general direction of its cultivation, does the ginning, finances and markets the crop, etc., receives 25%. The population of the Sudan is comparatively small, but with a Government appreciated by the people and consequent settled conditions time will remedy this difficulty.

There are other propositions in the Sudan for rain-grown and irrigated cotton in the neighbourhood of Tokar, Kassala, etc. At Tokar, a large acreage is flooded annually, but, unless some scheme of irrigation is devised for the control and distribution of the waters of the river Baraka, cotton-growing at Tokar is limited to about 25,000 bales. At Kassala, there is even a larger proposition so far as irrigation is concerned, to Tokar; but the great drawback to the immediate development of this large area is the absence of means of transport. At present, the cotton from Kassala is carried to Suakim, a distance of about 250 miles by camel. A railway is, therefore, urgently wanted to connect Kassala with the existing Sudan railway at say Thamiam. Such a line would cost roughly about two millions sterling, and I do not know of anywhere where the money could be more usefully spent. It would mean the giving of much employment to our own engineering workers for the making of the rails, engines and rolling stock, and it would open up a valuable producing area. Further than that, I feel sure that shortly after this railway is completed at least 100,000 bales of first quality Egyptian cotton would be added to the supply, in addition to which there would be other valuable products, plus the transport of cattle, large numbers of which are raised and sent to Egypt.

I consider that the Sudan is certainly one of the most promising areas we have. Its capabilities are enormous, and there is little doubt that, eventually, it should produce fully one million bales of excellent cotton, although, of course, this quantity can only be obtained as the irrigation facilities are extended and when the necessary railway transport is provided to Kassala, Tokar, etc.

UGANDA.—Uganda itself has an estimated area of about 110,000 square miles, and a population of over 3,000,000. It is of course a black man's country like Nigeria, and it has also a highly intelligent coloured civilisation. Here again, cotton is grown as a native industry. Twenty years ago, cotton was unknown in Uganda; to-day it represents the principal industry of the Colony, cotton heading the export list and forming about 80% of the total. The natives cultivate numerous small plots which in the aggregate amount to a considerable acreage.

It is from Uganda that we are receiving the largest quantity, and, for its class, the best cotton from any of the new fields. It is very gratifying to record that the 1920-21 crop was a record one, the number of bales exported being over 81,350 as compared with 52,000 bales in 1920. This result was achieved under the most adverse conditions, as many of the ginners and traders were not in a position to buy cotton. This Uganda cotton is about $1\frac{3}{16}''$ to $1\frac{1}{4}''$ in length, and it is used against stapled American as well as Upper Egyptian for counts ranging from 30's to 46's twist, also 42's to 44's weft.

Unfortunately, the industry in Uganda is not run quite on the same lines as in Nigeria, and there are many large European and Indian firms established in the Colony who purchase cotton from the growers. When prices are in the buyers' favour there is usually a great deal of competition, and values are forced up, but when prices are down on this side, this scramble for cotton ceases. Recently, there was some danger of the crop not being bought, and the Association, which is not out to make large profits out of cotton, stepped in and purchased nearly 12,000 bales, which was as much as their local staff could possibly deal with. Acting on representations from the Association, the Government also took a hand and purchased the crop in a number of districts where there were no other buyers.

Prospects for the future are the opening up of new areas, although the development of the crop depends rather upon increased individual planting together with better transport, which, as elsewhere, is a vital question. On the other hand, Uganda is rather fortunate in having a large network of lakes upon which most of the internal transport is done. As regards the railway, every bit of cotton—in fact all other produce as well—that is exported has to go down the Uganda railway, which runs from Kisumu on Lake Victoria through Kenya Colony, to the port of Mombasa, and as the prosperity of the Colony increases, so better transport facilities become necessary. I believe Uganda is capable of producing half a million bales of cotton annually, given reasonably good conditions.

TANGANYIKA TERRITORY AND KENYA COLONY.—Tanganyika Territory, which was formerly German East Africa, is a large country of about 348,200 square miles, the population of the area under British Mandatory Rule being about 4,000,000. Before the war, the Germans had devoted a great deal of attention to the development of cotton growing; conditions, however, are rather diverse, and the results varied considerably. There are certainly possibilities for the industry, although the areas are rather detached and require to be studied separately. An agricultural staff has been appointed, and it is possible that some substantial progress will be made. With a view to stimulating progress in the district immediately south of Lake Victoria, known as Mwanza, the Association acquired a ginning factory which at one time belonged to the German firm of Hansing and Co. Last season, about 350 bales were produced in this area. The prospects for this season are for about 1,000 bales in this neighbourhood, but efforts are also being made in the other districts and the total production from all sources last year amounted to about 7,500 bales, and the prospects for this season are approximately 10,000.

North of Tanganyika Territory lies the Colony and Protectorate of Kenya, formerly known as the East African Protectorate. The population of the Colony has been estimated lately at 4,000,000, and its area is approximately 209,000 square miles. The largest town is Mombasa, the principal port for both this Colony and Uganda.

Briefly stated, it may be said that cotton growing in Kenya has not been a success, though there is evidence that under certain conditions it might become so on a large scale in the future. Trials have been made near Lake Victoria in the Kavirondo district, and also in the Valley of the Tana River, and on the British side of the Juba River. About 500 bales were produced last year, and the prospects for this season are about the same. Progress in any direction, however, must inevitably be comparatively slow among tribes which have so recently come into touch with civilisation, and whose methods and outlook cannot be easily changed. To succeed in effecting a substantial improvement in the native agricultural progress, and in increasing production, a large number of instructors will be required. A few European farmers have grown a small quantity of cotton on their estates, along with other crops, such as maize, sisal, coffee, flax, citrus fruits, etc., and if there is a continuation of high prices for cotton these planters might be induced to proceed further.

NYASALAND AND RHODESIA.—I will now pass to another Central Africa possession, namely Nyasaland, known to many people as British Central Africa. The territory comprised in the Nyasaland Protectorate is a strip of about 520 miles in length, and varying from 50 to 100 miles in width. The area is roughly 40,000 square miles, or about one-third the area of the British Isles. The most southerly portion of the Protectorate is about 130 miles from the sea as the crow flies. The administrative area includes the concession of Chinde leased from the Portuguese Government, from which merchandise for British territory is transhipped free of all Portuguese duties.

The soil and climatic conditions are most suitable for the cultivation of cotton and tobacco. Nyasaland has earned an enviable reputation for its cotton, and, with care in the selection of seed and cultivation so as to produce a suitable staple, there are fair possibilities. I should add, however, that the cultivation of cotton is on the dual system, *i.e.*, partly by European planters, and partly by natives who work their own land. The total production last year was about 4,500 bales. What is wanted by the natives, however, to get them to stick to cotton, is a steady remunerative price instead of greatly fluctuating prices, and if this can be assured there are certainly possibilities for an extension of the industry. Of course, the country is not very large, but I consider the outlook, given efficient transport service, promises about 100,000 bales.

A railway from Port Herald, the inland Port of the Protectorate, to Blantyre (113 miles) is open for traffic. An extension to Chindio on the River Zambesi was opened in 1915, and a further extension to Beira, the coast port, was completed and opened for traffic a few months ago. A further extension northwards from Port Herald to the southern end of Lake Nyasa is also projected, and when the full scheme of transport has been carried out and the difficulties overcome, it is confidently hoped that Nyasaland will become an indispensable means of communication between the interior of Africa and ports of shipment to the commercial centres of Europe.

A few words may be here added about Rhodesia. Some years ago, the British South Africa Co., in conjunction with the Association, started a cotton plantation near Livingstone, but it proved somewhat of a failure owing to the shortage of labour, pests, etc. Recently, the farmers in both Northern and Southern Rhodesia have again gone in for cotton, along with other crops, but not on a very great scale, and a company known as the North Charterland Company is conducting operations in the Fort Jameson District, in Northern Rhodesia. The great difficulty is transport, and it is doubtful if there can be any large development until that territory is connected by railway with either the Zambesi or Blantyre.

UNION OF SOUTH AFRICA.—Since 1910, cotton has been exported from the Union of South Africa, but the quantity up to 1916 was not very large. In that year, about 580 bales of 400 lbs. were produced. Last year, the total had reached just under 3,000 bales. These results indicated that cotton of very useful quality can be produced in the Union, for, besides those districts in the Transvaal, Natal, including Swaziland and Zululand, there are large tracts of land which have a soil suitable for cotton culture. These latter districts are, however, at present uncultivated, and their development must largely depend on the question of labour supply. It is not anticipated that the cotton growing industry will develop satisfactorily on its own account in the hands of native farmers, and European supervision appears necessary in order to make full use of the native labour and to secure the successful growing of a somewhat difficult crop. The area of the Union is about 473,000 square miles, and the population just under 7,000,000. With an efficient Agricultural Staff, and transport, prospects are fair, and I believe South Africa is capable of producing 100,000 bales per annum.

MESOPOTAMIA, OR "IRAQ."—We have heard a lot about Mesopotamia from time to time. Two years ago, the Association sent out a delegation to enquire into conditions on the spot. The possibilities appear to be very considerable, but the potentialities cannot be proved until the country is settled. The rainfall is so small that the summer cultivation of the country must depend entirely upon irrigation. At present, it may be possible to produce roughly 100,000 bales on land provided with water from existing works; but the ultimate possibilities of the country must rest with a sound irrigation system and a people settled down to peaceful pursuits, when as much as 1,000,000 bales might be produced annually. A very good type of cotton, the progeny of an American long stapled variety known as Webber, has been established, which is marketed under the name of Mesowhite. The British Cotton Growing Association has a ginnery at Baghdad, and handles the cotton grown in that area. The total area of the districts comprised within the British Mandatory sphere is about 150,000 square miles, and the population is roughly 2¾ millions. The country is of course capable of supporting a population many times in excess of its present inhabitants, if irrigation is developed and extended, as undoubtedly the wealth of the country depends entirely upon agricultural development.

AUSTRALIA.—The subject of cotton growing in Australia has loomed very large before the public during the past few months. I might say here, however, that the Association has always taken a keen interest in the question as to whether cotton growing can ever be a successful commercial proposition, and has devoted considerable attention to the possibilities of Queensland, which undoubtedly is capable of producing a fair quantity of cotton. This State of Queensland which has an area of 670,500 square miles—5½ times that of the United Kingdom—comprises the whole of the North Eastern portion of the Australian mainland.

The great problem in Australia is labour. and the question yet to be decided is as to whether Queensland will be able to produce the quantity of cotton she is talking about producing. Anyhow, a start has been made—principally due to a guarantee which the British Cotton Growing Association made of a price of 18·00d. for all clean cotton of good quality forwarded to them for sale in Liverpool. At the same time, a stipulation was made that the Association's loss was to be limited to an amount of £10,000, and although the cotton for its class is exceedingly good it did not come up to our expectations as regards length; the grade is excellent, and the staple about $1\frac{3}{16}$″. It is gratifying to us to know that the Association's action has resulted in Queensland producing over 1,250 bales last year, whilst for this season the prospects are for between 3,000 and 4,000. Further than that, the other Governments of the Commonwealth have been going into the matter, and it is just possible that Australia might produce considerable quantities of cotton in the near future. According to the latest advices, between 100,000 and 150,000 acres have been planted in Queensland alone. Provided climatic conditions are favourable, this should result in a crop of between 30,000 and 40,000 bales, which cannot be regarded as a bad result for the third year.

WEST INDIES.—The fertile islands and mainland colonies which now form the British West Indies have a total area of just under 120,000 square miles, and a population of approximately 2,000,000. Some of these islands at present produce the finest Sea Island cotton grown. The total amount produced last year was about 5,000 bales. Of course, the crop is liable to setbacks from unfavourable growing conditions, or the advent of diseases and pests such as the pink boll-worm, which has recently made itself known in the West Indies. The West Indies, however, have been especially fortunate in having a splendidly equipped Imperial Department of Agriculture which possesses an excellent staff of scientifically trained men.

There is a possibility of increasing the present production to about 10,000 bales, but the quantity is limited owing to the fact that the islands are rather small, and that there are other industries such as sugar, limes, etc.

INDIA.—I must make some reference to India, because it is held by many, and perhaps with some justification, that India offers the best prospects of large and quick returns. The production last year exceeded 5½ million bales; but there is one serious disadvantage connected with Indian cotton, and that is the fact that the bulk of it is far too short for anything but the coarsest yarn, and only few spinners in this country can use it. Nevertheless, efforts are being made to improve the present native types, and with some degree of success.

The British Cotton Growing Association is directly interested in India and has recently acquired an interest in an area of 7,500 acres in the Punjab for the purpose of growing cotton scientifically on a commercial scale. These operations are being followed with keen interest by other large growers in the neighbourhood and, naturally, any success will have an important bearing on the production of improved cotton.

GENERAL.—There are many other places where experiments have been carried out and where a certain quantity of cotton is grown, especially in Cyprus, Ceylon, Malta, Fiji, British Guiana, etc. My remarks have been confined, so far, to the possibilities of cotton growing within the Empire; but there are many other countries where cotton can be grown, some of which have been brought to our notice in a very forcible manner. I would refer particularly to Peru and Brazil. Brazil has an area suitable for cotton growing, according to Mr. A. S. Pearse, larger than that of the United States of America and where the conditions of the climate and soil are as favourable as in any other part of the world. A delegation is now on its way to Brazil to study the conditions, and we shall no doubt hear more about it on its return.

Then, of course, our Allies, France, Belgium and Portugal, are all making determined efforts to establish cotton growing in their own Colonies and Dependencies in Africa and elsewhere, and I would particularly refer to the success which Belgium has obtained in her Congo Colonies. Here there is an enormous area which contains suitable soil and climatic conditions together with a population devoted to agriculture, and their efforts have resulted in the production of approximately 3,700 bales per annum under the administration there. With an increased staff of experts, there is no doubt very large quantities of cotton could be produced in the Belgian Congo.

This concludes my survey of the new sources of supply. What does it all amount to, and what is the outlook for the future? The total amount of cotton grown in new fields in the British Empire last year was just over 165,000 bales, as compared with 105,000 bales in 1920. Since the Association began operations in 1903, it has been largely responsible for the production of over 1,100,000 bales of cotton, so that something really tangible has resulted from our efforts. I may say here that this has not been easy work. One cannot get natives to grow cotton all at once. Very great difficulties have had to be faced, necessitating sound judgment, energy, tact, and courage on the part of those called upon to act. For example, railways had to be built in Northern Nigeria, Nyasaland, and Uganda; a great deal of time had to be devoted to the getting out of statistics and estimates for the new railways; deputations had to be organised so as to bring pressure to bear upon the authorities to get these proposed railways sanctioned, and then, of course, followed the time necessary for their construction. The same thing applied to those countries which had irrigation possibilities, as for example the Sudan, where it was necessary to build barrages. Then again, at times of a plethora of cotton from the United States and consequent low prices, it was necessary to stimulate prices in the new fields by guaranteeing the grower a sufficiently high price to make the growing of cotton attractive, and from time to time considerable financial risks have been run by the Association. Owing to the great world war, about five valuable years of work have been lost. Looking back, however, I think we may safely say that the foundations for a great industry have been well laid, and it is only a matter of time and foresight, coupled with energy and perseverance, for our Colonies to provide us with sufficient cotton for the requirements of the mills of Lancashire. I would also emphasise the fact that this is a great Imperial work, and Lancashire has not undertaken it purely from selfish motives; every additional bale of cotton produced in Empire fields, in Africa and elsewhere, will increase the spending power of the native, with the result that there is the possibility of largely increasing our own business in those areas, more especially in those countries where cotton-growing is a native industry and where there is already a fair demand for Lancashire goods. This means, in its turn, that the revenues of the railways and customs will be increased—in short, more revenue generally for the colony. It is only some few years ago that grants were made from the Imperial Treasury amounting to many hundreds of thousands of pounds; to-day these grants are not made, and this is chiefly due to the advent of cotton-growing.

Whilst here, I must record our grateful thanks to Mr. Winston Churchill, M.P., as Secretary of State for the Colonies, and to his predecessors in this office, and also to the permanent Officials at the Colonial Office, together with the Governors of the various Colonies and Protectorates, for the deep personal interest they have taken in all matters connected with cotton-growing in the Empire, and, last but by no means least, to the different Departments of Agriculture without whose help and co-operation it would not have been possible to have made any headway.

I feel convinced that large quantities of cotton can be produced, and I consider that the actual and potential sources of supply, besides India, Brazil, Peru and Egypt—that is so far as I can see at present, and which give the greatest promise—are Nigeria, Uganda, and the Sudan. I venture to suggest that the future Empire cotton zone, or belt, will lie between lines drawn about fifteen degrees north of the Equator and five degrees South, embracing Northern Nigeria, the Sudan, Uganda, etc.

There is every reason to extend the growth of cotton as rapidly as possible in all parts of the world, for not only will this tend to increase the general supply of cotton, but the very fact that the basis of supply is broadened will tend to steadier prices and thus defeat the manipulations of the speculators. Further than that, it is improbable that in any one year climatic conditions would be unfavourable in all parts of the world, so that it stands to reason that if a larger proportion of the supply of the raw material is obtained from India, Africa, or elsewhere, all who are dependent for their livelihood on cotton can regard the vagaries of the weather in the United States with comparative equanimity.

In conclusion, perhaps it would be as well if I said a few words on the formation of that new body, the Empire Cotton Growing Corporation, which has recently come into existence, because some doubt seems to exist as to the work this Corporation is going to perform. As the result of representations made to the Prime Minister in 1916, a Committee was appointed by the Board of Trade to investigate the best means of developing cotton-growing within the Empire and to advise the Government. After the fullest investigations, this Committee published its Report. Among other things, a new permanent body was recommended, with greater powers than the British Cotton Growing Association possessed, and rather differently constituted. This has now been set up and is known as the Empire Cotton Growing Corporation. Some of the best brains in Lancashire are on the Advisory Council of the Corporation. Its headquarters are in London. It is only to be regretted that the Corporation has not made much faster progress than it has, but this has been owing to circumstances over which the responsible officials have had no control. First of all, the Corporation's finances had to be put in order. A grant from H.M. Government was made conditional upon the trade itself finding its share, and it was suggested that this should take the form of a levy of 6d. per bale on all raw cotton used. A private members' Bill to make this payment legal was thereupon prepared and introduced in the House of Commons on July 11th last, and on its second reading was referred to a Committee of the whole house. Owing to opposition, however, it was not found possible to pass it through all its stages last session, but it is hoped it will go through some time next session. Meanwhile, things have not been standing still. A special mission was sent out last year to Nigeria and a report has been issued giving the result of Sir Hector Duff's investigations. Other missions were also despatched, one to Nyasaland and one to Tanganyika, and as a result of their reports experts are to be sent out to both these places to assist and advise the Governments of the respective colonies as to the best means whereby the industry may best be developed. An officer has also been appointed for research work in the West Indies. Further, most valuable work has been done recently in getting together a deputation to wait upon Lord Balfour for the purpose of obtaining the necessary money for the completion of the Gezira Dam. The general lines which the Corporation intend to follow in order to develop the possibilities of each cotton-growing country are:—(1) administrative work; (2) scientific work; (3) commercial work. Under "Scientific work" is comprised research on the purely scientific side of cotton-growing and the practical advice on agricultural details that will frequently have to be given to native cultivators. Help will therefore be given in the training of men in British Universities and elsewhere to do the scientific work required and also of selecting men to form a staff of practical agricultural advisers or inspectors and of giving them the special training best calculated to make their work as effective as possible. When these men are properly trained they will be attached to the Agricultural Departments of the various colonies for special work in connection with cotton. This is most important work, because it is certain that if the scientific growing of cotton is to be extended there must be a better supply of men competent to give advice and assist the natives and other growers. Mr. Richard H. Jackson has just been appointed the Chairman in place of the late Mr. John W. McConnel. Mr. Jackson's work in connection with the British Cotton Growing Association gives him special knowledge of the subject, and I look forward to the new Corporation making sound and rapid progress. I would also add that the B.C.G.A. is to retain its separate identity and will work in close co-operation with the new Corporation, but its chief work in the development of new areas will be on what might be termed the commercial side.

I must pay a tribute to the interest which is taken in this great Imperial movement by our President, who has also been appointed the President of the new

Corporation. Lord Derby takes the keenest personal interest in this work; in fact he is a great power in our midst. Under his presidency I hope that we shall in the not very distant future realise my personal aim and ambition, which is to see produced in our Empire all the cotton that Lancashire requires for her mills. This, however, will not be done without much hard work; fresh difficulties will have to be overcome and new problems tackled; but I am sufficiently optimistic to feel that one day this aim will be an accomplished fact.

[The paper was illustrated by a large number of lantern slides having reference to the various fields under review.]

DISCUSSION.

The CHAIRMAN said it appeared certain that more land would have to be put under cultivation for cotton. The author of the paper, unfortunately, was indisposed and unable to attend, but his assistants (Messrs. Griffiths and Oldfield) had, respectively, read the paper and explained the slides most effectively.

Mr. J. W. KERSHAW proposed a vote of thanks to Mr. Himbury and his assistants. The biggest difficulty in regard to Empire grown cotton, said Mr. Kershaw, was the matter of colour, whilst for equal staple, it was not, in his own experience, as strong as American. West African cotton was not as brown as formerly. Peruvian could be put into American, but not so with African.

Mr. A. POLLITT seconded, and said that if extended cultivation of cotton were necessary surely it was desirable that the extension should refer to our Colonies.

Another speaker said that cotton from the Sudan was often apparently badly ginned. He agreed with the remarks of Mr. Kershaw.

Mr. OLDFIELD, replying, said he thought Mr. Kershaw was referring to cotton from Southern Nigeria. Samples of a new type were now available and he was sure Mr. Kershaw would agree, after inspection, that great strides in improvement had been effected. The office of the B.C.G.A. at Manchester was intended to provide the facilities of an information bureau, and inquiries would always be welcomed.

NOTES AND NOTICES

LONDON SECTION OF THE INSTITUTE.

The formation of a London Section of our Institute has long been contemplated. Movement in this direction has frequently been suggested, but, for various reasons, no really definite form was given to the idea. Recent events have indicated, however, that the matter should be no longer delayed. Sir Frank Warner, K.B.E., who has played an exceptionally important part in the development of the Institute, more particularly during the period in which he carried out the duties of the office of President, has kindly taken a leading interest in the movement. The Council of the Institute has unreservedly welcomed the proposal, and now the London Section is actually formed. A Section Committee has been elected, and Sir Frank Warner has accepted the position of Chairman, whilst Mr John A. Todd, the well-known authority on cotton economics, has been good enough to act as Honorary Secretary, at least until the organisation is in a more advanced state. The Council of the Institute has indicated a broad-minded attitude on the movement, and expressed a desire to afford every facility possible for its development. The first step taken by the Section was in the direction of widening interest in the organisation and strengthening the membership, whilst preliminary consideration has been given to the activities to be embarked upon. In connection with the first-named matter, it was decided, with the full consent of the central body, to promote an invitation luncheon meeting. This event took place at the Cannon Street Hotel, on Monday, the 11th December, and a record of the proceedings will appear in our next issue. Meanwhile, it is known that a great many provincial members of the Institute view with immediate satisfaction the prospects of the establishment of a substantial Section in London. The late Sir William Mather, it may be recalled, frequently urged activity in London in connection with the Institute, and, at a meeting at which the existing Foundation Fund was given a decided impetus, he even went so far as to express the hope that, ultimately, the headquarters of the Institute would be located in the Metropolis.

TWO-COLOUR DYEING.

The announcement at a meeting of the Manchester Section of the Society of Dyers and Colorists, held at the University, Manchester, on the 17th November, of the discovery by Professor A. G. Green and Mr. K. H. Saunders of a dyestuff which makes two-colour dyeing possible at a single operation, represented a triumph for the advocates of research. It was pointed out that the whole matter opens up great possibilities in the dyeing of mixed materials, and, once that is accomplished, it will be the starting point for other and newer discoveries. There may be finality to these things, but that point is a very long way off—so far remote that it is almost non-existent. The announcement offers a practical proof that bread cast on the waters in the way of research still has a habit of returning after many days in multiples of its value, to say nothing of the further promises it brings with it. If there are those among the industrial community who do not see the practical value of research, and it is to be feared that some still linger with us, here is hard matter for them to consider. Two-colour dyeing in the manner described may not in itself be a very great matter; that is what may be argued by these die-hards. But that is to miss the whole point, which, to reiterate, is that all these new things lead to greater things, and we have to follow along the roads opened up and pursue them to the end, sparing neither the means nor the energy. We want it all, and more, to set the textile industry on its feet again, and what we do now, both in the way of money and energy, is an investment for the future that should bring us something even more welcome than big dividends. —R. C.

COMMERCIAL AVIATION.

It would be too much to say at present that the aerial service established between Manchester and London will be a permanent success. As a service, it has proved efficient, short as is the time it has been running. What is really needed is a sufficiency of support, on which depends the question as to whether the business is to become permanent. Or, to put it another way, whether we shall continue to develop it, or let it lapse for a while and then start it all over again, and again tackle the trouble of convincing people that it is a good thing. It goes without saying that the country needs all the transport resources that invention, improvement, and development can give us. The trading community is interested in the success of the service. It is evidence to this end that the Manchester Chamber of Commerce has set up what is in effect an aviation committee to help to push things along from the point of view of the Manchester trader. This represents a movement which ought to encourage those responsible for the running of the service. The service has not been started, perhaps, at the best of times, with the winter months to face, but if, as is sincerely to be hoped, it can keep going during these months, and it will not be the weather that prevents it, then there is hope. Next year, we may be regarding these daily arrivals and departures as a commonplace of our industrial and social life. All the while it is developing from the side of the social life, the service will become of more and more value to the business community. —R. C.

TRANSACTIONS.

In the case of the last issue of this Journal (November), a few pages of "Transactions," referred to in the list of contents on front page of cover, were inadvertently omitted by the printers. These pages appear in the present issue. The order of numbering of pages has not been affected by the omission in question.

GENERAL ITEMS AND REPORTS

COTTON GROWING IN AUSTRALIA.

Some time ago the Empire Cotton Growing Corporation received a request from the Queensland Government to provide an expert to advise them generally in the development of cotton growing in that State. The Corporation considered that this was a direction in which they might render assistance, since in their opinion expert advice in scientific agricultural practice and in the organisation of the industry is essential in order to establish on a firm basis the production of cotton of a sufficiently high quality to make its cultivation an economic proposition in Australia. The Corporation have secured the services of Lieut.-Colonel G. Evans, C.I.E., under an agreement for three years, and it is hoped that he will leave for Queensland at the end of December. Mr. Evans was recently Director of Agriculture, Bengal, where he had general control of all the cotton work. He formerly held the post of Principal of the Agricultural College, Nagpur.

NOTTINGHAM UNIVERSITY COLLEGE.

Arrangements have now been completed by the Council of the University College, Nottingham, for the establishment of the Department of Textiles as a fully-constituted branch of work, and Mr. Wm. Davies, M.A., has been appointed to the Professorship. The organisation of the department has been completed in a remarkably short time, owing largely to the active co-operation of the textile interests of the Midlands, under the chairmanship of Mr. Herbert C. Roe, of Messrs. Cooper, Roe & Co., Ltd., Nottingham. The department is now supported by the various trade associations to the extent of over £1,200 per annum, and a full-time staff of lecturers and demonstrators has been appointed. The value of the practical apparatus which has been installed, chiefly by the hosiery machine builders, approximates to £7,000, and the range of hosiery manufacturing operations is complete. The Textile Testing Bureau, established over a year ago, has been largely taken advantage of by the trade of the East Midland area.

All these activities synchronise with remarkable financial assistance being given by prominent public men in Nottingham, notably Sir Jesse Boot, who has given a site and £150,000 for the erection of buildings which, along with an additional £100,000 by an anonymous donor, will enable the buildings of the new East Midlands University to be proceeded with, the Textiles Department of which will form an integral part.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH.

The Annual Report of the Committee of the Privy Council for Scientific and Industrial Research (H.M. Stationery Office, 3s.) offers a comparatively brief record on the part of the Committee—a record dealing with estimates for 1922-23, expenditure of Research Boards and Committees, Research Association, position of funds held by the Imperial Trust, and the total expenditure of the Department during 1921-22. The bulk of the document is taken up by the Report of the Advisory Council of the Committee—a report which occupies about 100 pages, and which, as usual, forms extraordinarily interesting reading, providing a most complete and extremely well presented survey of the whole position with regard to the activities of Industrial Research Associations and the development of research in the National and Imperial interests.

In the first-named report, it is shown that the actual net expenditure of the Department from public funds, exclusive of grants to research associations from the capital of the million fund, amounted during 1920-21 to £427,432 and during 1921-22 to £338,552. For the current financial year, ending March 31st, 1923, a sum of £342,641 is provided. Grants to research associations in 1921-22 amounted to £86,355. Expenditure by grants-in-aid to other bodies reached £8,287 and was met partly from the vote of the Department and partly from the interest of the million fund. Grants to students, research workers, and scientific workers (to enable the last-named to employ assistants or to purchase equipment) absorbed £47,005. The expenditure of the Department on headquarters' administration was £37,560. The total expenditure of the Department during the financial year 1921-22 was £525,584—made up of £273,193 from the Exchequer, £65,358 of interest of the million fund, £86,355 from the capital to the fund, and £100,677 from fees for tests and special investigations for outside bodies, from contributions of the shipbuilding industry for research in the Froude Tank, and from repayments by the fighting services for research undertaken directly for them.

The Advisory Council's report commences with a lengthy introduction dealing with the steps taken to meet the clamant need for the utmost possible restriction of public expenditure. Revision after revision having been effected, it was agreed that responsibility for any further reduction in the estimates must be undertaken by the Government, and it was clear that the Geddes Committee endorsed the opinion which the Advisory Council had formed of the absolute and direct necessity of the work on which the Department is engaged, and was satisfied with the steps taken to carry it out with the utmost economy.

It is urged that four activities of the Department—the National Physical Laboratory, Fuel Research Board, Geological Survey and Museum, and Food Investigation Board—represent engagement on fundamental research on which the future welfare of our population and the development of our industries must largely depend.

Dealing with Research Associations, it is shown that 24 associations have received licences and 22 are in active operation. It is pointed out that these associations cannot look for further grants from Parliament when the million fund is exhausted, and that those responsible for their administration must take stock of the position on the assumption that in the sixth year of their existence one-half of their previous incomes will cease. It is insisted that definite results must not be expected at an early stage in the work of an association, but the report proceeds, nevertheless, to give a detailed answer to the question as to whether evidence is already available that any research association has actually done work of real value to the industry which created it. Several instances are named, and in the case of textiles it is mentioned that the British Cotton Industry Research Association has recently completed a research resulting in the production of an instrument for recording the regularity of yarns, and that the method of determining the diameter of yarn and its variations cannot but have a profound effect in affecting the finished product after its application has been more fully determined. Further, it is recorded that as a result of the study of bast fibres, the Linen Industry Research Association "have gained knowledge of the internal structure of the so-called ultimate fibres of flax, hemp, and ramie which is likely to be of considerable industrial importance. They have now found means whereby flax and hemp fibres may be distinguished readily one from the other with certainty at all stages of manufacture into yarns or finished cloth and damask; a matter which cannot fail to play an important part in maintaining the purity of linen manufactured goods. A machine has been devised for taking autographic stress-strain records from yarns and, by means of this machine, a study has been made of the influence of various factors, such as weight, twist, boiling, bleaching and sizing, on yarn behaviour. By research into the selective breeding of flax, a pedigree strain has been developed which gives a yield of fibre per acre much in excess of anything at present being produced."

Part II. deals with the co-ordinating research boards, and it is stated that these boards have extended their policy of enlisting the co-operation of research associations. The work of the Radio Research Board, Oxygen Research Committee, Adhesives Research Committee, National Physical Laboratory, Fuel Research Board, Lubrication Research Committee, and others is brought under review, whilst under the heading of Developments in the Organisation of Research for the Empire the establishment of the Empire Cotton Growing Corporation takes prominent place. The report is signed by Sir William S. McCormick (chairman) and Sir H. Frank Heath (secretary), and thanks are expressed to the members of the many boards and committees attached to the Department for help given freely and ungrudgingly.

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TRANSACTIONS

THE CHEMICAL CONSTITUENTS OF RAW COTTON.

By Robert George Fargher, D.Sc., and John Charles Withers, Ph.D.
(The British Cotton Industry Research Association).

I.—HISTORICAL INTRODUCTION.

Although no systematic examination of the constituents of raw cotton would appear to have been undertaken prior to 1860, the presence and importance of constituents other than cellulose had been recognised even to the extent of controversy.

A. Penot (1)* in an article on bleaching, included in the substances to be removed, resinous matter natural to the filaments, the pigment of the plant, a fat, a "cupreous" soap, and a calcareous soap, and gave short accounts of the existing knowledge of these materials; whilst Persoz (2) noted the presence of (*a*) a colouring matter, (*b*) a "peculiar resin," insoluble in water and not readily soluble in alkalis, to which he attributed the role of a reserve and "protector" of the colouring matter from the action of decolourising agents (*c*) fatty matter, and (*d*) inorganic salts.

The question had also attracted the attention of the French Academy of Sciences (3), where there was prolonged discussion as to whether cellulose existed in one or more forms. Fremy held that more than one existed, basing his argument on the differing behaviour of cellulose from various sources towards Schweitzer's reagent, and introduced the term *para-cellulose* to cover the more difficultly soluble forms; whilst Payen considered this difference apparent rather than real and attributable to incrustation with gum and other foreign matters. He thought that a layer of infinitely small bubbles of air condensed on the surface might to a lesser extent exert the same effect. Some 30 years earlier, he had shown that the epidermis of plants was covered with a very thin envelope containing fatty matter, some nitrogen, and silica. His experiments had been extended by Brongiart and by Mitscherlich, the latter supposing the covering medium to be a slender coating of "suberic matter," "a suberic material capable of yielding suberic acid and also succinic and nitric acids," to which coating he ascribed the difficulty of "wetting" fresh cotton. Fremy recognised in this coating all the characteristics of a fatty substance, "cutine," which, on saponification, yielded a substance with the properties of a fatty acid.

The first systematic investigation was reported to the Manchester Literary and Philosophical Society on February 4th, 1868, by Schunck (4), who boiled two samples of cotton yarn (East Indian, variety "Dhollerah," and middling Orleans), with sodium carbonate in an open kier, and examined the flocculent precipitates obtained on acidifying the dark brown liquors with sulphuric acid. These amounted to 0·34 and 0·48 per cent. of the cotton respectively and yielded (*a*) a substance designated "cotton wax," the analyses of which are in fair agreement with an alcohol $C_{24}H_{29}OH$; (*b*) margaric acid (a eutectic mixture of palmitic and stearic acids); (*c*) two "colouring matters," one freely and the other sparingly soluble in alcohol, the composition indicating rather a mixture of partially hydrolysed proteins; (*d*) pectic acid; and (*e*) albuminous matter. By fusion of the crude extractive matter with sodium hydroxide, he isolated a substance closely resembling tyrosine, whilst incineration yielded 2·3—6·9% of ash, consisting chiefly of the oxides of iron and aluminium, aluminium silicate, calcium sulphate, and sodium sulphate.

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* Figures in parentheses refer to Bibliography on pp. 15-16.

II.—GENERAL DIFFERENTIATION.

The first attempt to figure the cotton hair is generally attributed to Thomson (5) in 1834. Crum (6), in a series of communications dealing with dead cotton and with the manner in which cotton unites with colouring matters, depicted longitudinal and transverse sections of cotton hairs in various stages of maturity, and dealt with the effects of mercerisation. The examination was facilitated by the employment of specimens dyed with madder on an aluminium mordant. His results discredited the earlier idea that the hair was a hollow tube filled with air and more or less collapsed, and replaced it by that of a hollow sheath enclosing a deposit of cellulose.

Very shortly afterwards O'Neill (7), by microscopical examination of the action of Schweitzer's reagent on the hair, approached very closely the modern conception. He considered that cotton exhibited (*a*) an external membrane distinct from the true cell wall or cellulose matter, (*b*) spiral vessels situated either in or outside the external membrane, (*c*) the true cell wall or cellulose, and (*d*) an inner medullary matter.

More recently, Haller (8) has described the microscopic appearance of the fibre and distinguished three parts—the *cuticle*, the *cell membrane*, and the *lumen*.

The *cuticle*, consisting of "cutinised cellulose," has a finely grained or fibrous structure, is insoluble in ordinary cellulose solvents but soluble in strong alkalis, and is resistant to boiling under pressure with lime or even with sodium hydroxide of 2—8°Tw. It is, therefore, so Haller considers, very doubtful whether the "cutin" in the cuticle is a fat as suggested by Wiesner.

The *cell membrane*, consisting of almost pure cellulose, is more or less coloured, the pigment being resistant towards common solvents, but destroyed by long contact with oxidising agents. The membrane is soluble in ammoniacal copper hydroxide solution ("cuprammonium"), treatment with this reagent leaving the cuticle and inner skin hanging in shreds.

The *lumen* contains dried protoplasm, which extends also into the adjacent layers of the membrane. The protein is rendered visible by staining with safranine, the hairs being steeped in a solution of the dye in dilute acetic acid, and then washed with water and boiling alcohol, when the reddened protoplasm can be distinguished under the microscope, especially if the dyed fibre has been treated first with "cuprammonium." Haller suggests that in mercerised cotton the cuticle is entirely lacking, and that in dyed unmercerised cotton the colour is only absorbed on the surface, whilst on mercerisation penetration occurs, this accounting for the deeper colours. In a later paper (9), he concludes that the outer membrane consists of two structural elements which show little difference under normal conditions but are readily differentiated when the cellulose is transformed into oxy- or hydrocellulose.

Levine (10), by chemical and bacteriological treatment, followed by microscopic examination, draws the conclusion that there are five structural elements involved :—(*a*) the *outer layer or integument*, which is the encrusting layer and forms the cementing material of the fibre, being a mixture of cutinous, pectinous, gummy, fatty, and other components; (*b*) the *outer cellulose layer*, a distinct spiral comprising a limited number of components, perhaps one or two, and possibly consisting of impure cellulose; (*c*) the *secondary layer of deposits*, made up of components which in no case have a spiral structure and are 5 to 10 in number; (*d*) the *wall of the lumen*, a spiral much the same as the outer layer, but differing in chemical composition; (*e*) the *lumen*, the substance of which is structureless and nitrogenous. The evidence on which the conclusions are based is not detailed.

A comparative study of the materials for making cellulose esters has led Noyer (11) to suggest that the cuticle consists of oxycellulose, which is porous, has great osmotic properties, and is not acted on by esterifying agents, but allows these to penetrate into the fibrils by osmosis. Konig and Rump (12) have dealt recently with the chemistry of vegetable cell-membranes, dividing the difficultly soluble portions into three classes—*pentosans*, *hexosans*, and *lignins*. In each of these, one part, termed *proto-*, is rendered soluble by enzymes or by water at 2 to 4 atmospheres pressure. A second and larger part, termed *hemi-*, becomes soluble on boiling with 1 to 3% acids at 2 to 4 atmospheres pressure, whilst a still larger portion, termed *ortho-*, is only dissolved by strong acids or by dilute acids under higher pressures. The *ortho-* group which includes cutin and suberin can be resolved further by treatment with weak oxidising agents, the lignins undergoing oxidation and the orthocelluloses and cutin remaining.

Many excellent sketches made by the help of the Abbé appliance illustrating the structure of the cotton hair are to be found in a series of communications by Minajeff (13), in which the behaviour of mercerised and non-mercerised cotton towards dyes is compared. The most recent contribution is that of Balls (14), who shows the existence of daily growth rings in the cellulose layer corresponding with the period of maturation of the fibre.

III.—PROXIMATE ANALYSES.

Although hundreds of analyses of the whole cotton plant have been recorded by American agricultural chemists, few reports on the fibre itself have appeared. The following data by Church and Müller are quoted by many authorities, including J. M. Matthews (15), although their value, in the light of more recent work, is open to question.

	Sample I.	Sample II.	Surat.	American	Egyptian
	%	%	%	%	%
Cellulose	91·15	91·35	91·35	91·00	90·80
Wax	0·51	0·40	0·40	0·35	0·42
Protoplasm, etc.	0.67	0·50	0·53	0·53	0·68
Ash	0·11	0·12	0·22	0·12	0·25
Water	7·56	7·00	7·50	8·00	7·85

Somewhat different figures are recorded, for example, in Bulletin No. 33 of the United States Department of Agriculture (16), which J. H. Barnes (16a) considers to be more representative :—

Cellulose	83·71%	Protein	1·50%
Ash	1·65%	Fat	0·61%

A few determinations of some of the mineral constituents of carding waste have recently been published by H. D. Martin (17).

Analytical Methods.—Two papers dealing with analytical methods may be mentioned here. In the first Barthelemy (18) describes the determination of water, ash, fats and waxes, pectic substances, lignose and cellulose in raw cotton. In the second, Schwalbe (19) outlines a scheme for the analytical investigation of vegetable fibrous materials, and proposes the determination of ash, moisture, fat, wax and resin, cellulose, furfuraldehyde, methylfurfuraldehyde and methoxyl group.

Roberts (20) has recently called attention to the fact that the inorganic constituents of a plant can only be determined accurately by extracting the plant itself with water and dilute acids. Part of the combined chlorine, for example, may be lost during ignition, whilst the amount of sulphate in the ash may exceed that originally present in the plant.

Detection of ligneous impurity.—Woody material in cotton may be detected by reason of its greater affinity for malachite green (21), the colour being retained after the addition of bleaching powder to decolorise the true cotton.

IV.—EXTRACTION WITH SOLVENTS.

The most complete reports on the amount of material removed by various solvents are those of Knecht and his collaborators (22, 23, 24, 25, 26). The following figures are typical :—

	Cotton Sliver.			Cotton Yarn.	
	Egypt.	Bengal.	Texas.	American.	Egyptian.
	%	%	%	%	%
Benzene	0·47	0.38	0·55	0·41	0·44
Alcohol	0·68		0·90	0·53	0·74
Water	1·46		1·61	1·66	1·51
Ammonia (1%)	0·48		0·39	0·43	0·50
Formic Acid(1%)	0·46		0·72	0·65	0·41
Hydrochloric Acid, cold dilute			0·43	0·66	0·54

By means of petroleum ether, Knecht has separated the benzene extract into two portions—"*cotton wax A*" and "*cotton wax B*." These are dealt with in the succeeding section, but it may be recorded that 72% of the extract from Egyptian cotton and 80% of that from American cotton dissolved in the petroleum.

Similar figures are given by Matthes and Streicher (27), who found that petroleum ether extracted 0·5% from Caravonica cotton (from North Queensland), 0·36% from Egyptian, and 0·34% from American. The same cottons after bleaching yielded 0·25, 0·26, and 0·32% respectively. Piest (28) extracted nine samples of cotton with ether, carbon tetrachloride and alcohol, and obtained small amounts of wax varying from 0·09 to 0·53%, and Barnes (16) has found that ether extracts from 0·188 to 0·618% from various Indian cottons. Knecht (25) has recently noted that one effect of destroying the fibrous structure of the extracted cotton mechanically is to release a further quantity of extractive matter.

The use of organic solvents on the large scale is mainly confined to the "degreasing" of cotton waste, for which benzene, petroleum, and chlorinated hydrocarbons have been employed. The pioneer work was carried out in this country by J. W. Mitchell (29), who originally tried carbon disulphide and benzene, but ultimately (29a) decided that benzene is the most satisfactory solvent. Goehrig (30), however, has applied such liquids to the cleansing of textile materials generally, and has described the necessary plant and precautions. Recently, the use of benzene in the removal of wax from linen has been protected (31, 31a).

Apart from the wax, little is known about the material extracted save that it appears to contain much mineral matter. In the case of the cotton yarns examined by Knecht (24), the alcoholic extracts were amorphous, brown, and hygroscopic. They reduced Fehling's solution, and the ashes contained respectively 17·9 and 23·4% of K_2O. The water extracts were similar, but did not reduce Fehling's solution so readily. They contained respectively 50·4 and 54·5% of mineral water.

Lester (32) has examined the aqueous extract of raw cotton, and gives the following figures for the extract :—Ash 39·2%, Fatty acids 62·3%, Soluble in ether 17·5%, Soluble in cold water 39·5%. The ash in the original cotton had been reduced from 0·82 to 0·21%, whilst the cotton still contained 0·31% of material soluble in ether.

Higgins (33) states that if cotton (or linen) is completely extracted with benzene, then treated with acid, washed and dried again, a further quantity of fatty acid, about 10% of the first amount of wax, may be obtained by boiling with benzene. The acid washings contain magnesium, from which the conclusion is drawn that some of the fatty acid is present as a magnesium salt. Knecht also reports that after extracting cotton with benzene and then bleaching, a further, but smaller, extract can be obtained.

V.—THE WAX OF COTTON.

The only investigation of cotton wax which is more than cursory is that of Knecht and Allan (23), who found that the benzene extract of raw cotton could be differentiated by means of petroleum ether into "*soluble cotton wax A*" and "*insoluble cotton wax B*." For the Egyptian cotton on which the main investigation was conducted the ratio was 72% of the soluble wax to 29% of the insoluble, whilst for an American cotton it was 80 to 20%.

"*Cotton Wax A*" is odourless, dull yellow in colour, and closely resembles beeswax in texture and fracture. It has m.pt. 66—67°C.; iodine value 28·55; acid number 44·1; and saponification value 84·3. About 18·8% is undissolved by boiling 96% alcohol. It is saponified with difficulty, but by using glycerol and sodium hydroxide it gives 47·5% of unsaponifiable matter, consisting of (*a*) hydrocarbons [hentriacontane ($C_{31}H_{64}$) and dotriacontane ($C_{32}H_{66}$) were definitely isolated]; (*b*) a phytosterol, giving an acetyl derivative melting at 127°C., but otherwise unidentified; and (*c*) fatty alcohols unidentified owing to lack of material. The soap yields palmitic, stearic, and cerotic acids.

"*Cotton Wax B*" forms a dark green granular mass, with m.pt. 68°C., acid number 4·03, and saponification number 83·3. The unsaponifiable portion yields 33·5% of a reddish-brown sticky wax melting at 63·6°C., and giving on acetylation a considerable quantity of a phytosterol acetate with m.pt. 122·4°C. The soap yields a small proportion of melissic acid.

Both Knecht and Piest (28) have ascribed reducing properties to cotton wax, as it appears to increase the "copper number" of cotton. The reducing agent may be similar to an aldehyde detected by Hoffmeister (34) in the wax of flax.

VI.—THE ASH OF COTTON.

According to Matthews (15), the ash of true cotton never exceeds 1%, but Barnes (16) contends that this is incorrect. Twelve Indian cottons, he found, averaged 2·48%, the extreme values being 1·34 and 3·99. The amounts of silica and chlorine present were in accord with the figures for total ash. Five samples of American cotton gave values ranging from 1·18 to 1·92, whilst two Egyptian samples gave 1·37 and 1·50 respectively. A two-ply 60 American cotton examined by Knecht (24) contained only 0·93%, a similar Egyptian sample 1·17, and a soft twist Egyptian 0·89% of ash.

In the above series of Indian cottons, the percentage of chlorine varied from 2·23 to 6·53, and the proportion of the ash insoluble in hydrochloric acid, ascribed to silica and silicates, from 4·44 to 28%.

Two complete analyses of the ash are quoted by Barnes, as follows:—

		Bombay.	Punjaub.
		%	%
Moisture in original fibre	....	2·23	3·78
Total ash in dry fibre	....	3·99	1·85
Constituents of the Ash :	SiO_2	15·56	14·40
	Al_2O_3	10·80	12·87
	Fe_2O_3	5·89	1·92
	CaO	9·75	10·65
	MgO	1·87	4·36
	K_2O	27·32	26·03
	Na_2O	4·51	8·40
	SO_3	1·96	2·52
	P_2O_5	3·26	4·46
	CO_2	12·19	8·03
	Cl	6·55	3·84
Undetermined :		0·34	2·52

Extraction with solvents effects at least partial removal of the mineral constituents. Thus in the experiments of Knecht already quoted (24) the alcoholic extracts of Egyptian and American cottons, from which the wax had previously been removed, consisted largely of mineral matter, chiefly K_2O, Na_2O, MgO, SO_3, CO_2 and P_2O_5. The ash of the former extract contained 23·4% K_2O, and that of the latter 17·9. The succeeding water extracts contained respectively 54·5 and 50·4% of mineral matter.

Lester (32) has compared the ash from the aqueous extract of cotton with that of the cotton itself. The latter contained 0·82%, and 0·61% was removed by the extraction. The constituents were as follows :—

	Ash of water extract %	Ash of cotton. %
Magnesium carbonate	6·84	5·11
Magnesium phosphate	2·65	13·10
Alumina	3·90	3·90
Iron oxide	trace	2·71
Silica	1·79	1·00
Calcium carbonate	3·80	13·50
Sodium carbonate	27·78	15·90
Potassium carbonate	13·82	—
Potassium sulphate	36·9	32·2
Potassium chloride	2·60	2·5
Sodium sulphate	—	4·6

Lester considers the " hygroscopic " properties of cotton to be due to some extent to the material extracted by water. Crace Calvert (35) found that nearly the whole of the phosphorus was removed by cold water extraction, and determined the phosphate content of a number of cottons. The percentages of soluble phosphate, calculated as P_2O_5, are as follows :—Egypt, 0·055% ; New Orleans, 0·049% ; Bengal, 0·055% ; Surat, 0·027% ; Carthagena, 0·035% ; Macao, 0·050% ; Cyprus, 0·050%.

When a sample of lint is burnt, the skeletal structure is preserved in the ash, which suggests that the mineral substances are present in the tissue of the fibre itself rather than as dried-up cell sap. The latter point is borne out by a consideration of the Indian cottons referred to in the foregoing analyses. The Punjaub sample is grown in very saline soil, is two months longer in the ground than the Bombay crop, and the district is one of the dryest in India, yet the fibre contains more moisture and less ash than the Bombay sample. It is noteworthy also that the sample with the larger proportion of ash has the larger amount of carbonate in the ash, and presumably, therefore, a larger proportion of its inorganic constituents in the form of salts of organic acids. The absorptive power of cellulose has also been advanced to account for the fixation of some of the mineral constituents.

Balls (36) has determined the specific salinity of the cell sap of pure strains of Egyptian cotton, and finds a salt content which varies not only with the salinity of the soil but also with the variety employed. Plants of two Egyptian strains growing with interlacing root systems showed differences of as much as 10 :7 in the salinity of their cell-sap.

VII.—THE PROTEINS OF COTTON.

The occurrence of nitrogen in cotton fibre seems to have been first mentioned by Schunck (4), whilst the presence of protein may be demonstrated by Haller's method (8). Our present knowledge is, however, rather of the disappearance of the nitrogen during extraction and bleaching than of the actual nitrogenous constituents.

Typical estimations of nitrogen are quoted by A. Schindler (37) as follows :—

Egyptian, raw	0·250—0·256%
American, grey, yarn....	0·138%
Texas, raw, cleaned	0·150%
Peruvian, red	0·280%

Action of solvents.—Knecht (24) has examined the removal of nitrogenous constituents by extraction with a number of solvents, his results with an American cotton containing 0·204% being as follows :—

After successive extraction with	Nitrogen content. American.	Egyptian.
	%	%
Benzene....	0·189	0·240
Alcohol	0·184	0·226
Water	0·175	0·218
Ammonia (dilute)	0·175	0·218
Formic acid (dilute)	0·168	0·211
Hydrochloric Acid (2°Tw.)	0·138	0·175
Bleaching powder (2° Tw.)	0·022	0·037

Treatment with inert solvents thus accounted for 14·1 and 16·7% of the nitrogen in the respective complex, and chemical treatment for 72·3 and 71·3%.

Role in dyeing.—Knecht and Fernandez (26) have suggested that as an albuminoid has been obtained from raw cotton, dye-affinity may be attributed to a definite substance, and in this connection it is worth recording that R. J. Flintoff (38) has discussed the function of added albuminoids as fixing agents in the dye bath. Haller (38a) has also shown that there is a substance in the cotton hair which has an affinity for stannous chloride.

VIII.—PECTIC MATERIAL.

Schunck (4) isolated from amongst the products removed from cotton by the soda-ash boil considerable quantities of a substance corresponding with the " *parapectic acid* " described earlier by Fremy. More recently, Knecht (24) obtained a similar product from the caustic soda boil which had been previously lime-boiled and soured. The material so obtained has received little attention, and the considerable literature on such products which has accumulated during the last decade is concerned chiefly with the pectic substance of sugar beet and of fruit juices.

Pectose is probably closely allied to cellulose. Fellenberg (39) has suggested that it exists in unripe or barely ripe fruits as a product insoluble in water which is neither a calcium salt nor a glucoside derived from pectin. It is readily converted by cellulose extractives into pectin and pectic acid, and by fermentation with pectase into pectin (vegetable jelly), the chief constituent of Irish moss. This fermentation is an important process in the retting of fibres such as flax, *B. amylobacter* and *B. comesii* being regarded as the active agents.

Fellenberg states that pectose is probably converted into *pectin* in ripe or over-ripe fruits. The latter swells and dissolves in water, but the viscous solution soon sets to a jelly. Pectose is a reversible colloid, not coagulated by silver nitrate, mercuric chloride, barium chloride, or a number of other salts, and with extremely pure pectin there is no coagulation even with alcohol.

On treatment with warm dilute sodium hydroxide, pectin loses methyl alcohol and is converted into *pectic acid* which is very soluble in alkali hydroxides, carbonates, or phosphates, and in most ammonium salts of organic acids. Ammonium oxalate gives a limpid solution, but alkali carbonates give mucilages. Its solutions in water are flocculated by the addition of salts. More prolonged action of alkali leads to *metapectic acid*, the ultimate product of the action of the usual bleaching agents. Pectic substances are almost entirely removed from the fibre in the scouring operations, which probably affect (40) the decomposition of metallic salts. In a recent process, it is proposed to eliminate pectic matter by the use of hot hydrochloric acid; it is claimed that the fibre is not seriously weakened by the treatment.

Methods for the extraction of pectin substances from plants have been elaborated by Bourquelot and Herissey (41), Wilhelmi (42), Schryver and

Haynes (43), van der Linden (44), Hunt (45), and Caldwell (46), and means for their estimation by Fellenberg (47) and Koydl and Stros (48). The constitution of pectin has received attention from Weisberg (49), F. Ehrlich (50), and Gartner (51). Ehrlich's work indicates that the pectin of the cell-membranes of plants is the calcium-magnesium salt of a complex anhydro-arabino-galactose-methoxy-tetragalacturonic acid. There is no evidence as to the mode of linking, save that the arabinose group is weakly and the galactose group strongly held. Gartner considers that pectic acid is a galactose-galacturonic acid, rather than a tetragalacturonic acid.

IX.—COLOURING MATTERS.

Little is known of the substances occasioning the colour of the cotton hair. Penot (1) observed that the colouring matter is soluble in alkalis, but not immediately, air and light, or chlorine, being necessary for its complete removal. Schunck (4) and Knecht (24) have isolated highly-coloured products containing nitrogen to which they are inclined to ascribe the colour, but the conditions under which they were obtained—by soda-ash and caustic soda boils respectively—together with the analyses recorded by Schunck, render it probable that they are decomposed proteins. Still, it is possible that the colouring matter may occur in combination with protein. Taylor (52) has noted that the colouring matter present in cotton is eliminated completely by the use of a hypochlorite, together with hypochlorous acid or chlorine, but not by chlorine, hypochlorous acid, or a hypochlorite alone, and has drawn the conclusion that two colouring matters are present.

The pigment of cotton is most pronounced in wild varieties, the hairs of which are more or less coloured by a reddish endochrome, especially in the parts more exposed to light. The colour deepens as the cotton ripens, and W. L. Balls (53) states that a profound change occurs at about the 27th day of the development of the boll. The young bolls " pickle " in a mixture of alcohol and acetic acid to a green colour, but the older bolls give a pink or bright red " pickle," and later, when the fruit is beginning to burst, the " pickle " is brown. The colour is increased by exposure to diffused light, but is often destroyed by sunlight, especially when the protoplasm is dead. It is also deepened by steaming (54).

In a recent communication (55), Brabham states that cottons varying in colour from light green to dark brown have been cultivated. The fibres are extremely fine, and the brown variety is stated to surpass in fineness any cotton hitherto produced.

The pigment is found chiefly in the lumen, but is also in association with the cellulose. Brazilian and South American cottons contain very little, but Egyptian cotton is so much richer in pigment that it can be readily distinguished thereby.

It is not known whether the pigment bears any relation to the " gossypol " of cotton seed (56) or to the glucosides found by A. G. Perkin (57) in cotton flowers.

X.—CELLULOSE.

The scope of this report includes only analytical procedure with regard to cellulose and its modifications. An excellent review of the subject has been made by J. F. Briggs (58), in which it is pointed out that many of the older methods, especially those of agricultural chemistry, merely indicate the proportion of ultimate fibre in the material examined, whereas a process is required which will isolate the realisable cellulose, reasonably unimpaired. That is, substances like lignin must be removed without altering the cellulose. For this purpose, Cross and Bevan's process receives the greatest measure of support, the lignin being destroyed by the action of chlorine. Waxes and other extractives may be removed either by means of sodium hydroxide or by extraction with benzene and alcohol. In a recent modification of Cross and Bevan's method (59) the material, after extraction, is treated alternately with chlorine and sodium sulphite.

In the case of highly lignified material, the alternative process of dissolving the cellulose and leaving the lignin may be employed. Digestion with fuming hydrochloric acid is recommended by Willstaetter and Zechmeister (60).

Cellulose undergoes change very readily, the chief modifications being (*a*) hydration, now regarded as an absorption phenomenon of the colloid cellulose, (*b*) oxidation, (*c*) acid hydrolysis, and (*d*) "depolymerisation." The first modification is roughly estimated by means of the absorptive power of the material, under empirical conditions, for iodine (61), substantive dyes (62), cupric hydroxide from Fehling's solution (63), or sodium hydroxide (64). Another approximate method for ascertaining the extent to which cellulose is "modified" is to determine its solubility in sodium hydroxide, Schwalbe (65) using a 5 per cent. and Jentgen (66) a 17·5 per cent. solution. The process is employed mainly in distinguishing various types of artificial silks. The most important clues to "modification" are afforded, however, by determining (*a*) the "copper number" (67), that is, the number of grams of copper reduced from Fehling's solution by 100 grams of the cellulose, the value being below 1 for purest bleached cotton and rising to as much as 16 in the case of oxidised cellulose, and (*b*) the viscosity in ammoniacal cupric hydroxide solutions. The latter method has been investigated very thoroughly in the Research Department, Woolwich Arsenal (68), where it has proved successful, after recognising that bright light and air must be excluded from the solution, that the cuprammonium solution must be fairly constant, and that the "falling sphere" viscometer is the most convenient measuring instrument. It is found that cotton treated with alkali hydroxides gives much less viscous solutions in "cuprammonium" than untreated cotton, and that the viscosity of nitrated cottons (in mixtures of alcohol and ether) varies according to the viscosity of solutions of the original cotton. Nitrated raw cotton gives the most viscous solutions, which fact suggests that the action of sodium hydroxide may be of the nature of "depolymerisation."

In connection with the estimation of cellulose, the "drying to constant weight" is important. Most authorities agree that "dry" cellulose is obtained by heating to constant weight at 105°C., and 105—110°C. is the temperature employed in most of the Continental conditioning houses, although the Testing House of the Manchester Chamber of Commerce uses 100°C. Briggs (58) suggests, as an alternative, drying in a vacuum over phosphoric anhydride, and drying over sulphuric acid under similar conditions has also been employed. Schwalbe (69) proposed the determination of "water of hydration," as distinct from "hygroscopic water" by distillation with toluene, the difference between the toluene method and the normal "drying" giving the "water of hydration." Later, however, (70) he found that the toluene method only estimated "hygroscopic" moisture. The question of the accurate determination of moisture has also been considered by Schmansky (71) and by Nelson and Hulett (72). The latter observers heat the cotton in a very high vacuum and condense the moisture in a receiver cooled with solid carbon dioxide. They have adapted the method to the determination of the temperature at which decomposition sets in and the rate of decomposition. The relations between cotton and water will, however, form the subject of a special review.

The practice of washing with alcohol before drying seems to be objectionable, for both Renker (73) and Briggs (58) report that cellulose obstinately retains alcohol which cannot be removed by heat.

Any attempt to review the properties of cellulose would at once open one of the largest chapters in organic and applied chemistry, but reference may be made, in conclusion, to an excellent summary of the reactions of cellulose and their application in the establishment of its chemical constitution recently published by H. Hibbert (74).

XI.—BEHAVIOUR OF THE MINOR CONSTITUENTS OF RAW COTTON IN TECHNICAL OPERATIONS.

The literature of cotton spinning, manufacturing, and finishing contains an enormous number of references to the behaviour of the ash, wax, protein, and pigments of raw cotton in these technical operations. The following notes may be regarded as typical of the information which is obtainable from such sources :—

(A) Spinning.

Effect of the wax in spinning.—It is generally agreed that at the customary temperature of the spinning mill the waxes in the fibre become soft and semi-liquid, and thus allow the proper working of the cotton. After spinning, the oil sets and cements the fibres. Spinning trials of Egyptian cotton deprived of its wax (22) showed that the material behaves very badly in the drawing and spinning processes, giving an excessive amount of waste, irregular results, and showing a tendency to adhere to the rollers. Finer counts give great trouble, and breakages are extremely frequent. In the loom, as warp, it is equally troublesome. Extraction with benzene after spinning, however, increases the strength, but diminishes the elongation of the yarn, as shown in the following table :—

		American.	Egyptian.
		%	%
Increase in strength	....	12·4	11·0
Decrease in elongation	....	4·0	9·9
Average counts	before	56·8	58·1
	after	58·2	58·9

The strength tests are the average of 100 measurements.

The addition of 2% of paraffin wax to the extracted yarn decreases its tensile strength by 33%. Yarn spun from extracted cotton is from 24·5 to 27% weaker than that from normal cotton.

(B) Scouring and Bleaching.

Losses during Bleaching.—It is usually stated that cotton yarn loses from 5 to 7% of its weight during bleaching, the figure for cloth being larger by the amount of material added during sizing. Jecusco (75), for example, states that American cotton yarn on boiling with 3% caustic soda and 2% sulphated oil at 15lbs. for 8 hours loses 6·45%, the loss increasing to 7·3% on full bleaching. Using soda-ash instead of caustic soda and following with a stronger hypochlorite solution, the loss in weight was 7·1%. Trotman and Pentecost (76) point out the necessity of considering the moisture present before and after bleaching in working out figures of this kind. In a number of carefully conducted laboratory experiments, the following figures were obtained for the loss during the soda boil :—

Reputed count.		Loss %		Number of tests.
24/2 American	....	5·30	....	7
32/2 ,,	....	4·01	....	36
40/2 ,,	....	4·35	....	15
70/2 ,,	....	3·90	....	29
70/2 Egyptian	....	6·54	....	8
80/2 ,,	....	4·59	....	12
100/2 ,,	....	4·35	....	18
120/2 ,,	....	4·60	....	12
150/2 ,,	....	4·55	....	6

The comparative effect of a number of reagents on the same cotton under standard conditions were found by Trotman and Pentecost to be as follows :—

Reagent.	Loss %
Potassium hydroxide	5·00
Sodium hydroxide	4·40
Sodium carbonate	3·70
Sodium borate	2·80
Sodium silicate	2·40

Removal of mineral matter during bleaching.—The mineral matter is speedily, but not completely, eliminated during the usual bleaching operations, the total loss at each stage being given by Hebden (77) as follows :—

Steep.	1st boil.	2nd boil.	Chemic.	Sour.
70·5%	87·3%	95·4 %	93·0%	95·0%

Knecht (24) reports that after lime boil, sour, soda boil, sour, chemic and sour HCl, the ash of a soft twist Egyptian sample had decreased from 0·89 to 0·15%.

Removal of the Wax in Bleaching.—The removal of the wax is one of the principal objects of the lime and soda boils, and their relative efficiency has been largely debated. It appears to be generally conceded that, as a single operation, the soda boil has the greater effect, as indicated, for example, by the following table (78), the figures being the percentages of ash, etc., left in the fibre :—

	EXPT. I.		EXPT. II.		EXPT. III.	
	Soda boil.	Lime boil.	Soda boil.	Lime boil.	Soda boil.	Lime boil.
Ash	0·26	0·52	0·26	0·50	0·42	0·56
Free fat	0·10	0·26	0·20	0·15	0·16	0·11
Fatty acids (as soap)	0·16	0·22	0·13	0·21	0·26	0·56
Nitrogen	0·05	0·07			0·07	0·07

It is when the lime boil is considered in relation to the lime-sour-soda-sour sequence that opinions differ. Both Higgins (79) and Trotman and Pentecost (76) agree that in the lime boil the saponifiable portion of the wax is hydrolysed and that the subsequent souring converts the insoluble soaps left on the fibre into free acids, which remain in close contact with the unsaponifiable matter, so that in the lye boil a soap is produced and rapid emulsification and elimination of the unsaponifiable matter result. The latter authors consider, however, that this result is achieved equally well by the direct soda boil.

The suggested mechanism of the lime boil is supported by the experiments of S. A. Shorter (80) and of Scheurer and Wallach (81) on the emulsification of mixtures of saponifiable and unsaponifiable oils. Higgins (82) quotes the following figures, obtained in the treatment of hanks of linen yarn :—

Treatment.	Decrease in weight. %	Wax remaining. %
Lime, lye, lye	21·8	0·06
Lye, lime, lye	—	0·046
Lye, lye, lye	—	0·16

Hebden (77) indicates that the removal of fats and waxes soluble in ether during the soda boil takes place as follows :—

Steep.	1st boil.	2nd boil.	Chemic.	Sour.
5·5%	20·4%	64·0%	67·8 %	69·6%

Trotman and Pentecost (76) give the following typical analyses to indicate the difference between good and bad soda boils of cotton goods :—

	After good boil. %	After bad boil. %
Mineral matter	0·05—0·75	1·00
Free fat	0·10—0·15	0·35—0·70
Fat as soap	trace	0·25—0·50
Nitrogen	0·05—0·10	0·25—0·35

They emphasise the utility of sodium carbonate and of borax as emulsifying agents, but consider that the scouring effect of sodium silicate is offset by possible mechanical damage due to the deposit of silica on the fibre. Other suggestions for the more effective removal of waxes include the use of (*a*) a soap solution containing benzene (83), (*b*) a mixture of potash soap, carbon disulphide and olein (84), (*c*) resin soaps, (*d*) benzene and other solvents brought into emulsion with Turkey-red oil, and (*e*) Turkey-red oil and oleic acid (85).

Knecht (23) considers it improbable that cotton wax is saponified under normal bleaching conditions, the wax being only partially removed, and then by emulsification. He quotes the following figures in support of the statement :—

Scouring agent.	Time.	Wax removed. %
Soda ash, 4°Tw.	4 hrs.	30
Sodium hydroxide, 2°Tw.	4 hrs.	28
NaOH, 2°+Marseilles Soap (5% of wt. of cotton	25 mins.	45
NaOH, 2°+Marseilles Soap (5% of wt. of cotton)	4 hrs.	64
NaOH, 2° Tw.+ resin soap (5% of wt. of cotton)	25 mins.	73

Although the use of resin soap appears to be so effective, it has been suggested that if the water used contains lime or magnesia, resinates may be precipitated on the fibre and eventually produce a brown colour (86). The efficacy of potassium hydroxide compared with sodium hydroxide (76) and of strontia in relation to lime (87) has been considered. Potassium hydroxide is said to remove 20% more wax when used in equimolecular proportion for the same time, whilst strontia is supposed to exert a saponifying action three times as great as that of lime and to give a superior general bleaching effect. There is, however, the possibility of tendering, due to oxidation.

The retarding effect of neutral salts and of hard water on the soda " boil " is considered by Trotman in a later communication (88). The same writer (89) points out that wax retained after boiling may protect the cotton from the action of the " chemic," whilst Graf (90) considers that the reducing agents present in the wax cause the " bleeding " of vat colours in the lye boil, and indicates methods of overcoming this. Kollman (91) has studied the fall in reducing power of raw cotton in the course of the bleaching process, the greatest change taking place after the lye " boil," when the majority of the secondary constituents are removed. Whether the " yellowing " of goods in storage is due in some measure to the wax appears to be undecided, Levine (37), Crowther (92), and Higgins (93) favouring this assumption, whereas Erban (94), Hebden and Freiberger (95) are of the contrary opinion.

In bleaching, cotton from which the wax has been previously removed yields a " white " much superior to the untreated cotton (23).

In all the more recent literature (78-95), an important series of experiments by A. Scheurer (96) appears to have been overlooked. Scheurer studied the saponification of tallow, cottonseed oil, and the fatty constituents of raw cotton in contact with cotton cloth, and came to the following conclusions :—(1) Sodium hydroxide is twice as effective as sodium carbonate in equivalent concentration: increasing the concentration of alkali from 5 to 10 parts per 1,000 is without sensible effect ; (2) mixtures of sodium hydroxide and sodium carbonate show maximum efficiency when the proportion of carbonate is equivalent to 25% of the total alkali, an effect which is ascribed to the mechanical properties of the solution ; (3) the addition of rosin increases the velocity of saponification, which is still further enhanced by increasing the concentration of the alkali ; (4) the saponification of cotton-seed oil in contact with the fabric is relatively rapid, and appears to increase the rate of saponification of the natural fatty constituents of the raw cotton; (5) neutral fats (triglycerides) are much more rapidly attacked by alkaline solutions when mixed with readily saponifiable oils, owing probably to emulsification; (6) whilst the rapidity of the action of lime is noteworthy, the complete removal of the fatty matter can only be effected by a subsequent acidification and boiling with sodium carbonate; (7) the general statement is made that complete saponification of the fatty constituents of cotton may be effected (*a*) by a single treatment with sodium hydroxide and rosin, or (*b*) by the lime—"sour"—soda-ash sequence, the latter process having the greater elasticity and certainty.

Effect of the Removal of the Wax on the "Wetting" Properties of Cotton.—Beadle and Stevens (97) pressed various samples of air-dried cotton into loose wads, 15 × 10 mm., weighing 0·1 gram each, and let them fall from a certain height on to the surface of a column of water. The time taken to pass through the surface was used as a measure of the "wetting" property of the cotton. The following results were obtained:—

Cotton, Raw	More than 24 hours.
,, Bleached but not scoured	31·3 seconds.
,, Boiled in 1·0% NaOH	12·3 ,,
,, ,, 2·0% NaOH	5·7 ,,
,, Boiled, bleached and boiled again	4·0 ,,
,, Extracted with ether and alcohol	0·5 ,,

The maximum effect of the caustic soda treatment was produced by boiling for three hours.

Removal of nitrogenous matter.—The effect of bleaching operations on the nitrogenous constituents has been examined by Schindler (37), Knecht (24), and Higgins (98). Schindler was mainly concerned with the action of sodium hydroxide solutions of increasing concentration, and found that after boiling with sodium hydroxide of 2°Tw. for 8 hours the nitrogen content of an Egyptian cotton was reduced from 0·250 to 0·065%. Increase of the concentration of sodium hydroxide to 10°Tw. reduced the nitrogen to 0·028%, whilst further treatment with bleaching powder of 1·5°Tw. reduced it to 0·003%. Using a still stronger solution of sodium hydroxide (77°Tw.), the percentage of nitrogen was reduced to 0·016—0·019. Most of the nitrogen expelled from the cotton remained in some form in the solution, and was not isolated as ammonia. The figures obtained by Higgins (98) for the elimination of nitrogen as ammonia by the method of Osborne, Leavenworth, and Brautlecht confirm this, an American yarn yielding only 0·018% and an Egyptian 0·034% of nitrogen as ammonia.

Knecht (24) gives the following figures for the various stages of the bleaching process, the nitrogen being expressed in terms of that originally present:—

After—	Percentage of N originally present which survives treatment.
Lime boil	54·0
Sour, HCl	40·5
Caustic soda boil	27·1
Sour HCl	16·8
Chemic.	6·7
Sour, HCl	5·8

The first three extracts were examined. The first contained 3·7% of nitrogen, but did not give a protein reaction. Treatment with alcohol precipitated a gelatinous substance resembling Schunck's pectic acid. The second yielded stearic acid and a small proportion of cotton wax, and the third, which contained 3·46% of nitrogen, appeared to consist mainly of brown colouring matter.

Higgins found that unsized yarn loses about one-third of its protein on steeping in salt solution, and formed the opinion that the usual process of scouring with caustic soda or by the lime—sour—soda-ash sequence removes all the protein. The treatment leaves about 8 per cent. of the nitrogen unaccounted for, and it is suggested that this residuum must be non-protein nitrogen, since Hebden (77) found that the first boil effected the removal of all the phosphorus but only 91·5% of the nitrogen. The total loss of nitrogen after different bleaching processes is given as follows :—

1st boil, 91·5%. 2nd boil, 91·7%. Chemic, 92·2%. Sour, 92·7%.

The importance of the complete removal of the nitrogenous substances in cotton is emphasised by Trotman (99), who has found that nearly all cases of bacterial damage to finished goods are associated with high nitrogen content.

(C) Destruction of Secondary Constituents by Fermentation.

For many years, malt extract has been employed to assist in the removal of starch from sized fabrics, but attention has recently been directed to the application of enzymes as a substitute for the alkali " boil." It was shown nearly thirty years ago by Herbert (100) that bacteria which destroy cellulose do not attack the cellulose molecule proper until adherent pectins, gums, and tannins have been decomposed. Recently, Levine (101) has examined the action of *B. amylolyticus*, *B. fimi*, *B. bibulus*, *B. carotovorous*, and *B. subtilis* (Ehrenberg) on unbleached cotton in a nutrient medium containing dipotassium hydrogen phosphate, magnesium sulphate, sodium chloride, ammonium sulphate, and lime. He found that the nitrogenous substances and constituents which are soluble in ether are efficiently removed, but that the impurities soluble in alcohol are only attacked by *B. carotovorous* and *B. subtilis*. In the case of *B. bibulus* and *B. fimi*, the cloth became weaker, which may have been due to the action of air on parts incompletely submerged. On the large scale, the material was incubated with the bacterial culture for periods ranging from 24 to 72 hours, with encouraging results. Finally, Röhm (102) has protected the substitution of the alkali " boil " by a " steep " in a 0·1% solution of pancreatin at 20—40°C. for some hours, other enzymes such as papayotin or ricinus ferments serving to the same end.

(D) Dyeing.

Influence of minor constituents.—Schwalbe (19) showed that substantive dyes gave lighter shades on extracted cotton, whereas methylene-blue and some other dyes gave darker shades. Rona and Michaelis (103) go so far as to affirm that the apparent absorptive power of cotton for dyes is really due to an exchange of mineral matter for dye, and support this view by the fact that in the absorption of methylene-blue the chlorine content and the hydrogen-ion concentration of the solution remain constant.

(E) Beetling.

Influence of wax.—It is almost impossible to obtain the effect of the beetle finish if wax is left in the cotton. Even the trace of wax left after scouring and bleaching may be sufficient to create this difficulty, and the use of unsaponifiable material in sizing the warp yarn would of course aggravate the trouble. For this reason, extraction with suitable solvents is strongly recommended by Fort (104), and a process has been patented which can be applied before or after bleaching, or after dyeing, and even while the fabric is wet (105).

(F) Steaming.

Cotton becomes yellow when exposed to steam, and it has actually been proposed to impart to white cotton the appearance of Egyptian varieties by steaming under 1 to 1·5 atmospheres pressure for 25 to 50 seconds (106). The yellowing is not due to the fatty constituents of the cotton, and, in fact, F. Erban has found that the phenomenon is intensified if the fat has been extracted (107). The " gums " in the cotton may contribute to the process, but, on the whole, fully scoured cotton is as liable to become yellow as raw cotton. The subject has been studied by Freiberger (108), who came to the following conclusions :—(*a*) Bleached fabrics show the strongest discoloration, those bleached in the cold being more susceptible than fabrics bleached in the warm; (*b*) fabrics bleached in the warm with sodium hypochlorite containing an excess of sodium carbonate are less subject to yellowing; (*c*) oxycellulose becomes quite one hundred times as dark as cellulose on steaming, but hydrocellulose is less affected than cellulose. The main cause of the yellowing of cotton on steaming is therefore the presence of oxycellulose.

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MEASUREMENT OF BREAKING STRESSES, EXTENSIBILITIES AND ELASTICITIES OF SINGLE FIBRES OF COTTON, ETC.

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Physical investigations on textile fibres appear to have been confined chiefly to measurements of length, diameter, and breaking stress. A few extremely rough estimations of extensibility (erroneously called "elasticity" in some books) have been made (for example, p.253 "Textile Fibres," by Matthews, 1916), but few details of measurement, or methods of obtaining the results, seem to have been published. Measurements of the true elasticity of a fibre, or its recovery from strain, have apparently not been attempted. Since the fibre is the physical unit of every textile fabric, an intimate knowledge of its properties, physical as well as chemical, is bound to shed light on phenomena connected with the behaviour of the fabric during manufacture and in everyday use. The balance to be described was designed for the exact measurement of breaking strength, extensibility, and "recovery from strain" of individual textile fibres. It has proved to be convenient, accurate, and comparatively rapid, and does not need any special training in its use. Consistent results have been obtained with it by a laboratory assistant with no scientific training after a few minutes of instruction in its manipulation.

A method of measuring the breaking strength of single fibres was described by Charles O'Neill (Manchester Lit. and Phil. Society). One end of the fibre was fastened to the top of a cylinder floating in water, the water being then gradually withdrawn by means of a stop-cock so as to avoid jerks on the fibre. Alterations and improvements in his apparatus have been made by various workers, *e.g.*, Yves Henry and by Hughes (1). Dr. W. L. Balls (2) gives a photograph of an automatic tester for single fibres which are "mounted on cards loaded into the magazine (left) which passes them one by one to the tester (centre), the strain being recorded on the drum (right)." The fibre was "strained by the tester at a constant rate against a spring balance which recorded the strain on a drum." Bowman (3) mentions "a lever machine with a sliding weight which was specially constructed for the author" for measuring strength of fibres; and still another machine for the same purpose is described and illustrated by Matthews (4). Finally, the Schopper machine, designed for testing breaking weights and extensibilities of yarns, has also been adapted for similar measurements on single fibres.

In most of these machines, it is obvious that the increase in the strain on the fibres must have been more or less jerky, the spring balance or the sliding weight employed not being at all an ideal method for smoothness of working. Still less are any of the methods suitable for the accurate measurements of extensibility or elasticity.

DESCRIPTION OF APPARATUS.

In order to test single fibres for breaking strength, extensibility, recovery from strain, etc., an apparatus has been constructed in this laboratory, the basis of which is a small Oertling balance. The pans were removed and replaced by :—(*a*) On the right—a bundle of magnetised steel piano wires, hung vertically, with half its length inside a solenoid of covered copper wire through which an electric current could be sent, and accurately measured by means of a sensitive ammeter; (*b*) on the left—a small weight, in order to counterbalance the magnet on the right. An auxiliary knife edge E (Fig. 1) was constructed, and rigidly clamped about half-way along the left arm of the balance. Suspended from this edge, but easily removable, was a special clamp FNA, to hold the end A of the fibre to be tested. The other end B of the fibre AB could be clipped vertically below this in another adjustable clamp BC, which was attached firmly at C to the central pillar of the balance. The fibre AB—usually of length 13·5mms. (5)—was mounted by means of bicycle cement in small double paper squares, thus :—

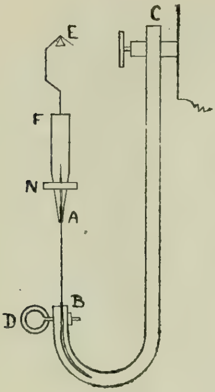


FIG. 1. Arrangement for clamping the fibre AB. The clamp FNA was suspended from the knife edge E, which was attached to the balance arm. The portion BC was secured to the central pillar of the balance.

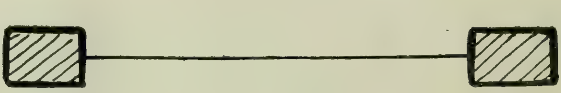


FIG. 1a. Mounting of Fibres.

The fibre is first inserted at A, the nut N pushed upwards into position to grip the paper square, and the clamp FNA hung on the knife edge E. The adjustable clamp B of the attachment BC is moved into position vertically below A, and the end B then secured firmly by means of the screw D. The balance can then be put in adjustment by lowering the beam supports, so that the smallest possible strain is put on the fibre. With the help of the counter balance it can be so arranged that when no current is passing through the solenoid the pull on the fibre shall not exceed 5 milligrams (*i.e.*, about 1/1000th part of the strain that an average cotton fibre will bear without breaking). The pull on the fibre can be increased gradually by passing a current through the solenoid, the magnetised wires being sucked into the solenoid with a force which depends on (*a*) the strength of the magnet (which remains sensibly constant) and (*b*) the amount of current through the solenoid, which is accurately measured by an ammeter, and controlled by a sliding resistance. The main object of this method of applying the strain on the fibre is to avoid sudden jerks, such as would be given if, for example, weights were added or taken away one at a time. Any required pull can be applied gradually and evenly by simply moving the contact slider, and this pull can be increased or decreased at will and accurately measured at any instant.

CALIBRATION OF AMMETER.

To determine the pull on the fibre corresponding to a given reading of the ammeter, different weights, from 0·2 to 15 grams, are suspended in turn from the clamp FNA in place of the fibre, and the readings of the ammeter observed when the current through the solenoid is just sufficient to balance these weights. A curve is then drawn giving the connection between " Reading on Ammeter Scale " and " Pull on Fibre." Such a curve is given in Fig. 2, and from it the pull on the fibre can be read at once when the reading of the ammeter has been observed. As an example, a certain fibre broke when the ammeter recorded 22·5 divisions; from the curve, it is seen that the breaking strain was 4·5 grams.

MEASUREMENT OF EXTENSION OF FIBRE.

In order to measure the extension of the fibre under load, a small rectangular plane mirror was attached in a vertical position to the balance beam and moved with it as the fibre extended or contracted. Another similar mirror, facing the first, but inclined at a small angle to it, was firmly secured to a stationary part of the balance. A beam of light incident on the first mirror (M_1M_1 Fig. 3) at a small angle to it is reflected three times at each mirror, and then passed on to a millimetre scale placed about 150 cms. away.

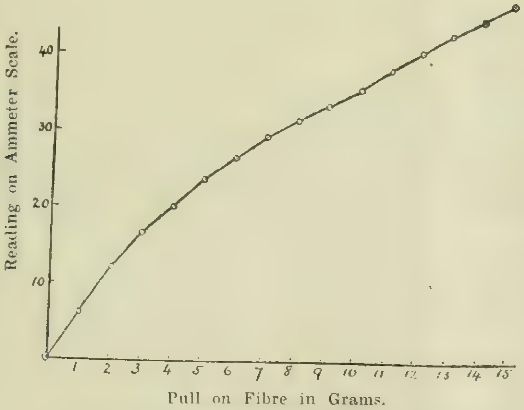


FIG. 2. Curve connecting " pull on Fibre in Grams," with " Reading on Ammeter Scale."

The arrangement is similar to that used by Poynting (6) in his measurement of the density of the earth. A small angular movement of the mirror M_1M_1 is sufficient to give a considerable displacement of the spot of light on the scale. In the apparatus used, it was found that an extension or contraction of only 0·0047 cms. of the fibre caused a movement of 1 cm. of the spot along the scale, *i.e.*, the magnification was over 200 times (=1/0·0047). An exceedingly small elongation or contraction of the fibre can thus not only be observed but also very accurately measured. The scale is placed at such an angle to the beam of light that equal increments of expansion or contraction of the fibre always give very nearly indeed equal amounts of movement of the spot of light.

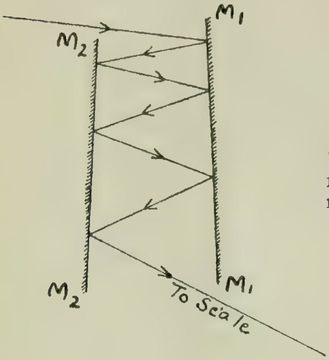


FIG. 3. Arrangement of mirrors M_1M_1 and M_2M_2 for measuring extension of fibre by multiple reflection of light.

EXPERIMENTS ON VARIOUS FIBRES.

(1) *Measurements of "Breaking Strain" and of "Extension at Break."*—A fibre of measured length (say 13·5mm) having been placed in position as shown in Fig. 1, the balance beam is carefully lowered (just as in the ordinary method of using a balance). This puts just enough strain (about 5 mgms.) on the fibre to pull it taut. The reading of the spot on the scale is then taken (say, 26·5 cms.). By moving the contact on the sliding resistance, a gradually increasing current is sent through the solenoid so as to suck the magnet into it and thus increase the pull on the fibre. The spot of light is seen to move upwards as the fibre increases in length. When the fibre breaks, the spot gives a sudden jump towards the top of the scale. The reading on the scale just before the fibre breaks is noted (say, 48·5 cms.) and then the reading of the ammeter is taken (say, 28·5).

The *Breaking Strain* is read at once from the graph and, from the figures given, is seen to be 6·6 gms. (Fig. 2).

The *Extension at Break* is (48·5 − 26·5) × ·0047 cms.; as a movement of 1 cm. of the spot means an extension of 0·0047 cms. in the fibre.

Extension = 0·103 cms. or 1·03 mms.

$$\text{Extension } \% = \frac{1{\cdot}03 \times 100}{13{\cdot}5} = 7{\cdot}6\%.$$

A large number of experiments were made with the object of determining the "breaking strengths" and "extensibilities" of various fibres. The mean results of some of them are tabulated below :—

TABLE I.

Fibres.	Breaking strength.	Extension as % of original length.
(7) Scoured Egyptian Sliver	7·2 gms.	7·4%
(7) Ditto Mercerised without tension (NaOH 45°Tw.)	6·7 gms.	12·2%
Wool (merino top cap)	7·85gms.	39·0%
Silk	4·01gms.	18·7%
Artificial Silk (viscose)	10·8 gms.	14·5%
Linen fibres from Aeroplane Fabric	19·5 gms.	5·1%
Bog Cotton	4·7 gms.	2·4%

The mercerised fibres in Table 1 were taken from the same sample as the unmercerised. The results indicate that mercerised fibres are slightly weaker than unmercerised, but when mercerised without tension their extensibility is over 60% greater. Wool is more than five times as extensible as cotton, and natural silk more than twice. Artificial silk (viscose) is also much more extensible than natural cotton fibres. Linen, however, is a good deal less extensible, though its average breaking strength is considerably greater than that of cotton.

MEASUREMENT OF "RECOVERY FROM STRAIN" OF VARIOUS FIBRES.

When a fibre is stretched, but without breaking, and the stretching force is then removed, the fibre does not, in general, recover its original length. The apparatus described above is eminently suitable for investigating the changes in length of a fibre under a varying pull. As the current through the solenoid is varied, the ammeter reading gives the pull on the

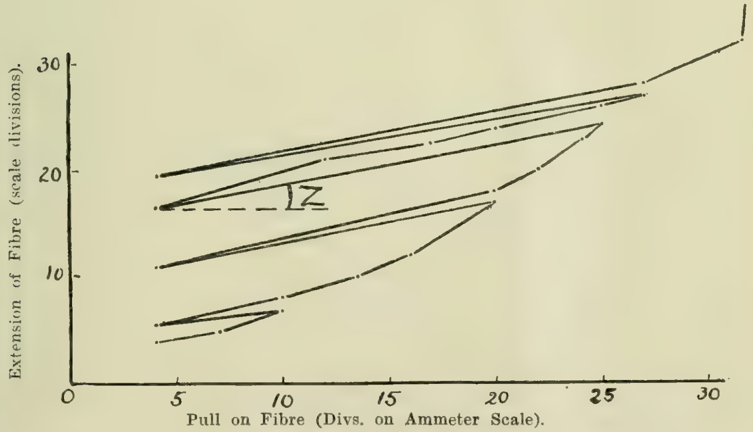


FIG. 4. Stress-strain diagram for Cotton Fibre, showing breaking strength, extension and recovery from strain (tan Z).

fibre at any instant, while the position of the spot on the scale enables the change in length of the fibre to be calculated easily at the same time. A series of simultaneous values of " stretching force " and " length of fibre " having been recorded, a " stress-strain " curve can be drawn connecting these values. Such a curve is given in Fig. 4 for an unmercerised cotton fibre. The " pull on the fibre " is recorded in " divisions of ammeter scale "; if necessary, it can be easily converted into " pull in grams " with the help of the curve in Fig. 2. The " extension of fibre " is given in " scale divisions." It can be expressed as actual extension by multiplying by 0·0047. For the sake of comparison, similar curves, obtained with

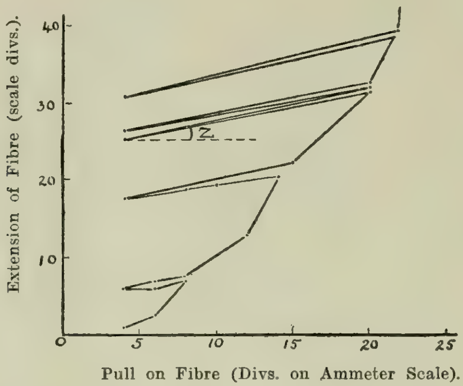


FIG. 5. Stress-strain diagram for Mercerised Cotton Fibre.

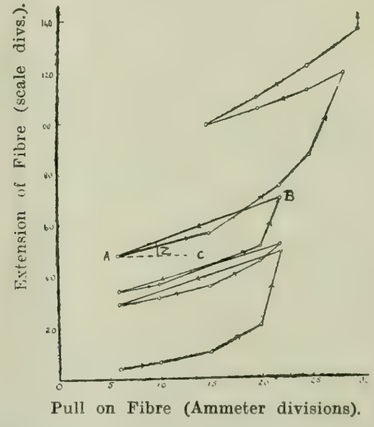


FIG. 6. Extension, recovery from strain (tan Z) and breaking strength of a Fibre of Wool

a fibre of wool (merino top cap) and one of mercerised cotton, are given in Figs. 6 and 5 respectively.

It is worthy of notice that when the pull on the fibre is reduced by a given amount (say, from 20 ammeter divisions to 4) the wool fibre shows a much greater recovery in the direction of length than does the cotton. A convenient measure of "recovery from strain" is given by the slope of the line AB in each curve, *i.e.*, the value of the tangent of the angle marked "Z" in each diagram. It is clear that the greater the recovery from strain the steeper will be the line AB. Steepness being measured by the tangent of the angle, the "recovery from strain" of the wool fibre is found to be 1·37, while that of cotton is only 0·37.

This property of recovery from strain is one that may throw much light on the behaviour of different fibres when woven into a fabric. It is in reality, of course, a measure of the true "tensile elasticity" as distinguished from mere "extensibility."

It was observed that in the case of cotton the recovery is fairly rapid, and takes place almost entirely in one step; with wool, however, there appears to be a large and rapid initial recovery, followed by a second, smaller, and slower one. The loops which frequently occur in curves constructed from experiments on wool fibres (see Fig. 6) are a result of the second stage of this recovery. If the measurements are carried out slowly, the loops do not appear. Measurements of recovery from strain gave the following mean results for the various fibres tested (Table II.) :—

TABLE II.

Fibres.	Recovery from Strain (tan Z) Arbitrary units.
Scoured Egyptian Sliver	·28 units.
Ditto mercerised without tension	·34 ,,
Wool (merino top cap)	1·33 ,,
Natural Silk	·87 ,,
Linen	·11 ,,

The results differentiate very sharply between fibres of wool, silk, cotton and linen. Comparison with Table I., column 3, indicates that "extensibility" and "recovery from strain" are roughly proportional.

ELASTICITY.

The true elasticity of a fibre may be defined as stress per unit sectional area divided by increase of length per unit length. It is impossible to obtain exact measurements of this quantity in the case of a fibre for the following reasons :—

(*a*) The fibre is not solid throughout, and its sectional area varies along its length, so that a correct measurement of section is impossible.

(*b*) A fibre is not perfectly elastic for ordinary stresses, *i.e.*, it does not completely recover its original length when the force applied is released.

Approximate values of the elasticity and of the tensile strength of a fibre can, however, be obtained as in the following examples (*a*) and (*b*) :—

(*a*) *Elasticity of Mercerised Cotton Fibre.*—In a particular experiment, a pull of 10·2 grams produced an elongation of 0·0552 cms. in a fibre of length 1·35 cms. Sectional area was approximately 0·000003 sq. cms.

$$\text{Elasticity} = \frac{\text{Stress per unit area}}{\text{Elongation per unit length}} = \cfrac{\cfrac{10{\cdot}2 \times 981}{{\cdot}000003}}{\cfrac{{\cdot}0552}{1{\cdot}35}}$$

$$= 0{\cdot}8 \times 10^{11} \text{ c.g.s. units.}$$

Elasticity of quartz fibre is 5×10^{11} c.g.s. units and of cast iron about 12×10^{11}.

(*b*) *Tensile Strength of Cotton Fibre.*—A fibre of 0·000003 sq. cm. sectional area broke with a load of 7·2 grams.

$$\text{Tensile Strength} = \frac{7{\cdot}2 \times 981}{0{\cdot}000003}$$

$$= 2{\cdot}4 \times 10^{9} \text{ dynes per sq. cm.}$$

(Tensile strength of steel is 15×10^{9} dynes per sq. cm.)

(1) " Development and Properties of Raw Cotton," p. 195, 1915.

(2) Ditto.

(3) " Structure of the Cotton Fibre," p. 264, 1908.

(4) " Textile Fibres," p. 254, 1916.

(5) The exact length of the fibre was measured when necessary by placing an electric lamp behind it and projecting the image of the fibre on to a screen in front with magnification 12 diameters.

(6) Proc. Roy. Soc., 1878, and " Density of The Earth," 1894.

(7) Mean of about 200 observations. Except the last, all others are the means of 30 to 50 results.

The foregoing investigations were undertaken at the suggestion of Dr. R. S. Willows, to whose helpful advice any success attained is largely due. Some preliminary experiments on the same subject, but with a different arrangement of apparatus, had already been done by Mr. F. H. Parker, B.Sc., before the present writer took up the work.

(*Received* 13*th December*, 1921).

THE STRESS-STRAIN CURVES OF VARIOUS YARNS.

By G. F. New, B.Sc., A.Inst.P. (The Linen Industry Research Association).

The apparatus used in this work is shown in Fig. A, and is based upon the wire-testing machine devised by Professor A. Barr, F.R.S., but possesses the following essential differences :—

The extension of the test-piece (1) is multiplied ten times on the graph by the use of two balanced arcs, one (2) having a radius equal to ten times that of the other (3). This component is cut out of sheet metal, and has guide strips soldered round the arcs to provide channels to contain the actuating threads (4) and (5). A sliding balance-weight (6) is clamped to a radial rod in the lighter sector.

The lower clamp (7) for the test-piece of yarn consists of a wing nut and a fast and a loose washer on a threaded bolt, which is soldered through a rectangular piece of sheet metal, 2″ × 1½″. This hangs in a vertical plane, and is pinned to a similar rear plate. Between the two plates, at each corner, is carried a guide wheel, cut out to engage with steel guide rods. These are readily adjusted and held with nuts in the slotted frame (8). This clamp plate is suspended from the top of the small arc by a thin cord or a narrow brass ribbon (4). The same material is used to attach the pen (9) and its carrier to the larger arc (5).

A more extensible spring is used than in the wire-testing apparatus, and its extension is communicated to the drum (10) by a weighted cord (11). The circumferential movement of the drum is twice the extension of the spring, because the driving cord passes over the pulley (12). Water is run into the can (13) at a uniform rate to apply tension to the yarn. In its present arrangement the apparatus is suitable for examining fine yarns, as the tension on the yarn is only half the weight of water added to the can. For examining coarser yarns, it is a simple matter to rearrange the spring-can-pulley system to give a yarn tension equal to twice the weight of water added. The pen carrier (14) is balanced by a weighted cord (15) hanging over two pulleys. To take up the frictional resistance in the two portions of the machine—the drum moving system and the pen moving system—jockey weights are applied to or removed from the two hangers (16) and (17), according as the yarn is being loaded or unloaded.

The apparatus is easily adapted for working under different conditions. By moving the yarn clamps, any length of test piece can be used; by screwing arcs with different radii on the yarn side of the balanced sectors more extensible yarn can be dealt with, and, as explained above, it is not difficult to adapt the instrument for dealing with yarns of different strengths.

The spring, recording drum, supporting hooks and pulleys can be obtained from G. Cussons, Ltd., Manchester. The balance piece, clamp-plate, and guide-frame can be made in any small workshop.

The inertia of the moving portions of any instrument of this nature will tend to smooth out the curves to a certain extent. At the rate of loading used in the present work, however, the accelerations of the moving parts are usually so slight as to be negligible in their influence on the general shape of the curve.

The machine has now been in use some little time, and the behaviour of a considerable variety of yarns has been investigated under widely divergent conditions. One outstanding factor whose influence on the character of the stress-strain curve has yet to be examined is that of humidity. All the tests, the results of which have been incorporated in this paper, were performed at humidities between 74 per cent. and 84 per cent., and the large majority between 78 and 83 per cent. In making the various comparative tests shown on any one diagram, care was taken to reduce to zero any differential humidity effects, by completing the work at the same relative saturation. By calibration of the spring, it was found that the interval recorded on the paper for an increase or decrease in load of 125 gms. was subject to a probable error of 3·9 per cent. The probable error in the mean slope of any curve obtained over a length corresponding

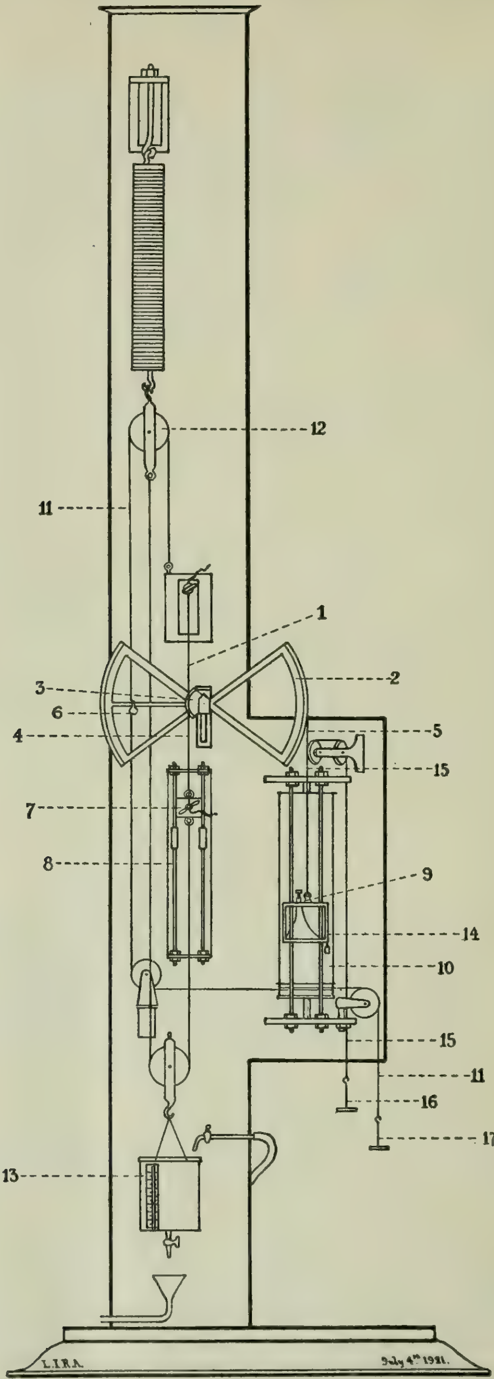


Fig. A.

to a load alteration of 125 gms. will therefore amount to 4·1 per cent. The probability of error in the general slope of a complete curve due to idiosyncracies of the load-recording system will be smaller than this in proportion to the square root of the strength of the yarn. For a yarn breaking under a tension of 1,250 gms., the probable error in the complete slope of the curve due to the recording system will be approximately

$$\frac{4.1}{\sqrt{\frac{1250}{125}}} = 1.3\%$$

It was at once noticed that the shapes of a series of curves from the same yarn were very similar. As a consequence, the number of tests it is necessary to carry out on a specimen of yarn in order to get a reliable shape for the mean curve is very much less than, for instance, the number necessary to attain the same reliability in the case of a tensile strength determination. Under average conditions it has been found, by calculating the probable error of the mean value obtained for the slope at any point and also the probable error of the mean obtained in breaking tests of the same yarn, that 10 stress-strain curves will give a mean curve which is more reliable than the mean value for breaking strength resulting from 100 breaking tests. This comparative uniformity in shape considerably simplifies the production of a characteristic curve for a yarn.

In deriving and presenting a curve which shall give a true picture of the behaviour of a sample of yarn, several methods are available. These include :—

(*a*) The selection of a suitable equation to fit the curves; the determination of the values for the co-efficient in its different terms, corresponding to each of the individual curves; and the deduction, from the family of equations thus obtained, of a mean value for each co-efficient, to produce a final mean equation.

(*b*) The measurement of ordinates at the same abscissae though the whole set of curves, and the derivation of means, from which a final curve may be constructed.

(*c*) By inspection of the set of curves, the selection of a particular curve which appears to be most typical.

(*d*) The reduction of the curves so that, in each case, the breaking stress is represented by a common length, and the subsequent averaging of the curves thus obtained, as in method (*b*). This method (*d*) is open to criticism, and is certainly inapplicable when the harshness of the clamps is suspected to have caused any of the yarn fractures.

Method (*a*) involves very protracted work, both in the selection of a suitable equation, and also in the subsequent determination of average values for the co-efficients. It would only be applicable to the curves of the simplest shape, but would possess the advantage of giving a complete final curve—from zero load to breaking point. This is unattainable when method (*b*) is used, unless all the set of yarn specimens break at exactly the same load. Unless this miraculous occurrence takes place, the slope of the final curve will be the mean either of a different number of individual curves at different portions of its course, or else of different relative portions of the individual curves. In neither case will the slope towards the breaking point be truly represented. If the shape of the curves is fairly simple, however, this method (*b*) may be used to obtain a reliable resultant curve showing the behaviour of the yarn from zero load up to some load less than the mean breaking strength of the yarn in question. In view of the abovementioned uniformity in shape, it is not a difficult matter to pick out from a set of 10 or 15 curves from the same yarn, a curve which shall be typical of the general behaviour of that yarn. The advantages of this method (*c*) are its simplicity and the fact that it gives a complete curve up to the breaking point. It is especially applicable, therefore, when only a qualitative comparison of two different yarns is desired, throughout the breaking process. It is used in this paper in compiling all diagrams except (4) and (7), the curve in each case being selected from at least 10 stress-strain diagrams for the particular yarn.

Method (*b*) is used when a quantitative evaluation is desired of the differences, possibly small, in the extensibilities of yarns under small and intermediate loads. In practice, the behaviour of a yarn under tensions less than the breaking tension is perhaps of even greater importance than the actual breaking strength, and the information to be derived from method (*b*) will, in many cases, be entirely sufficient. Method (*b*) has been used to obtain figures (4) and (7), the ordinates at the same 10 values of the abscissa being averaged from the set of 10 individual curves, to get each final curve.

In the production of all curves shown in this paper a fixed rate of loading (1 kilogram per minute) has been used. Experiments have been carried out with various rates of loading between ½ kilo. and 2 kilos. per minute, but no decided changes in shape have been found in the curves obtained. The distance between the fixed and movable clamps was, in all cases, except where otherwise mentioned, 30 cms. Some experiments have been made with specimens of lengths between 20 cms. and 70 cms., but, here again, no marked alteration in shape has been detected.

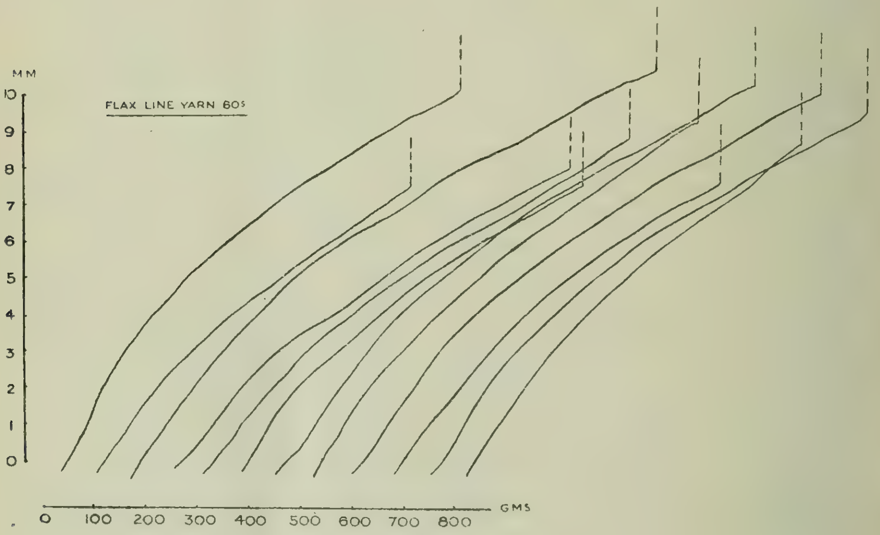


FIG. 1.

In Figure 1 is shown a group of curves obtained from wet spun 60's flax line yarn in the "green" or untreated state. The successive test pieces were taken at random from the same cut of yarn. It will be noticed that, in many instances, at the commencement, the curve has a slight downward convexity. This may indicate a greater initial resistivity to disturbance offered by the fibres or by the binding material. The next portion of the curve is the steepest, and from there onwards the steepness gradually decreases. Concurrently the curvature or rate of change of inclination decreases until, at the point of fracture, it almost reached zero, the graph being, at that point, very nearly a straight line. Now the slope at any point, being equal to the instantaneous value of $\frac{\text{the rate of increase in length}}{\text{the rate of increase in load}}$ is a measure of the extensibility of the yarn under that particular load, or, if such a term may be used in connection with a stress-strain curve of this shape, of the reciprocal of the longitudinal elasticity. It will be seen that the yarn becomes less extensible as it is loaded, and, as is usual with flax yarns, ruptures before the changing extensibility reaches a constant value.

A steel wire, when subjected to an increasing tension, gives a stress-strain curve of the general configuration shown in Figure 3. The curve is a straight line for the first portion, and in the state represented by this region, the steel may be spoken of as truly elastic —Hooke's law—which states that

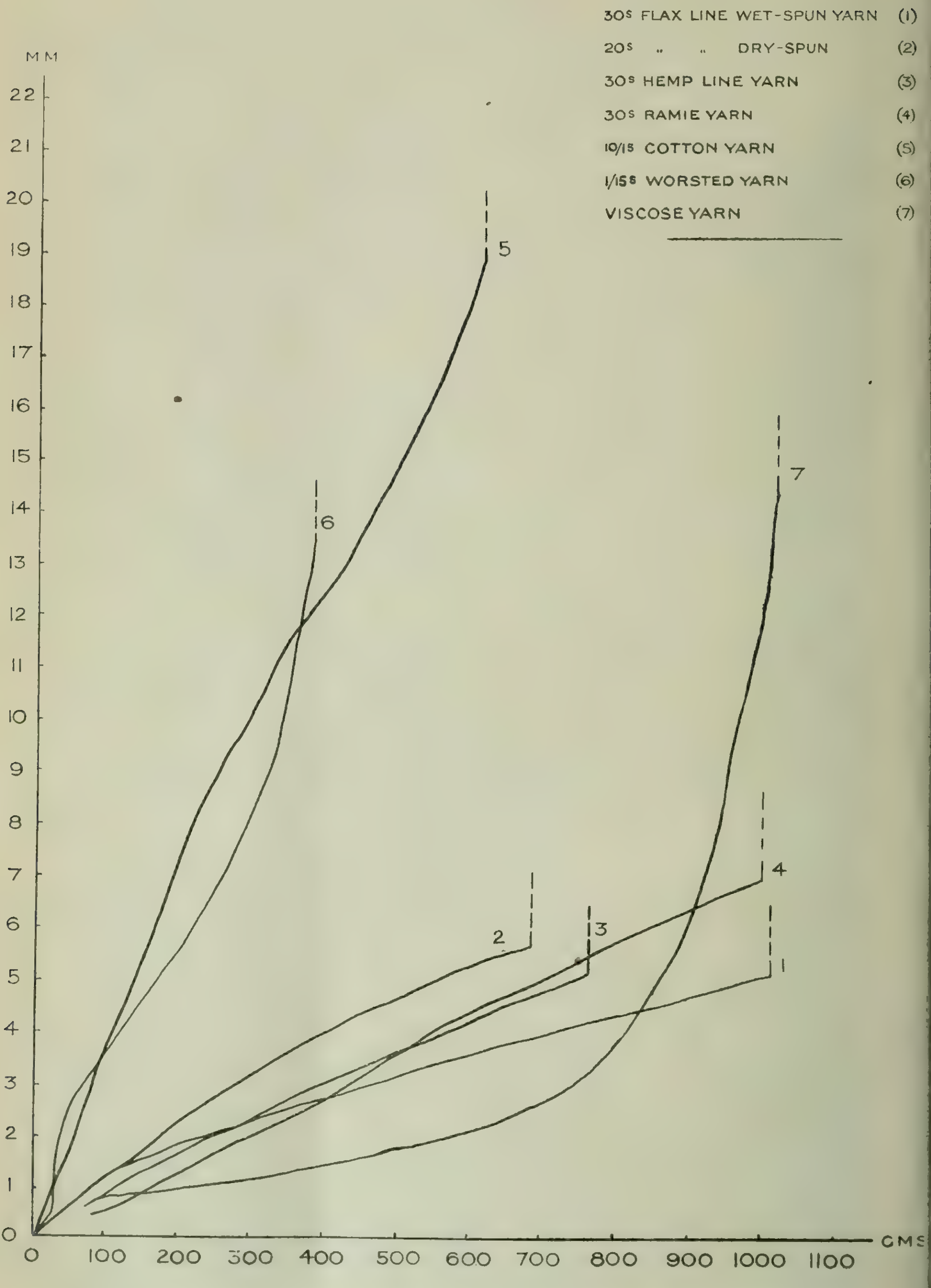
$$\frac{\text{the rate of increase in load}}{\text{the rate of increase in length}} = E \quad \text{(co-officient of longitudinal elasticity.)}$$

is constant—is applicable over the whole of the portion. On further increasing the tension, the yield point is reached and the instantaneous value of the extensibility undergoes a continual increase. With the sample of yarn under consideration, the opposite is the case. The value E becomes progressively more constant, and the material tends to behave more and more like a truly elastic body. Before it reaches this state, however, it breaks. Could it be imagined to resist fracture after this stage has been reached, the subsequent behaviour would probably follow, in a general way, that shown by the steel curve, the value of E rising to a maximum and then decreasing.

The decreasing slope of the flax yarn curve indicates the presence of some process or change which is most prominent at first and then becomes progressively less marked. This may be attributed to the slipping and locking, and pulling into closer contact of the fibres, causing a gradual tightening up. This process would naturally be most marked at the commencement, and would gradually approach completion. As may be seen from the curves, which in general do not become quite straight, the process is never quite completed : the yarn in an already tightened and locked portion, breaks down before the whole specimen is in a similar condition.

In determining the character and efficiency of this " hardening " or compressing process, the elastic properties of the gum will probably play a large part, perhaps more in a wet spun than in a dry spun yarn. Towards the end of the curve, the elastic properties of the fibre substance become more and more evident. If the curve could be continued it would probably again increase in steepness on account of the now predominant influence of these intrinsic properties.

The same type of curve is obtained, in a slightly modified form, with ramie and with hemp and also with dry spun flax and hemp yarns. In Figure 2 typical curves for these materials are shown. The curve for dry spun flax is shown with the stresses half their actual value. The slope at any point on the curve is therefore shown as twice its actual value. It can be seen, therefore, that the dry spun yarn gives a very flat trace which is only slightly curved, and that the steepness in the initial portions is much less marked than in the case of wet spun flax. The ramie shows a certain amount of irregularity in its trace, but the general trend is easily seen. The initial tightening process is less marked than in the case of the flax yarn, and the change in extensibility is but slight as the breaking load is approached. This possibly indicates that, in a ramie yarn, the fibre bundles are in closer contact than in a flax yarn and that the extension which takes place is due to slipping of fibres and bundles of fibres, without subsequent



30s FLAX LINE WET-SPUN YARN (1)
20s " " DRY-SPUN (2)
30s HEMP LINE YARN (3)
30s RAMIE YARN (4)
10/1s COTTON YARN (5)
1/15s WORSTED YARN (6)
VISCOSE YARN (7)
MM
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
0
100
200
300
400
500
600
700
800
900
1000
1100
GMS
1
2
3
4
5
6
7

Figure 2

locking; or it may be due, in part, to the existence of a smaller co-efficient of friction between moving components of the yarn.

The 30's hemp yarn also shows a greater uniformity in extensibility at various loads than is the case with flax.

The viscose curve was obtained from a group of 15 threads clamped in such a manner that they were not twisted about each other. Each individual thread consisted of 15 silk fibres twisted 4 turns per inch. In this material the fibres are continuous. Its strength will, therefore, depend to a greater extent on the tensile strength of the individual fibres than is the case with short fibred yarns. There is no binding material, and the cohesive or frictional properties of the individual fibres are not employed to as great an extent as in other yarns. The initial part of the curve, it will be noticed, is practically a straight line, and it may be assumed that this shows simply the extension of all the fibres. The smooth change in the curve towards the vertical is probably due to the fracture of individual fibres at an increasing rate. As each fracture occurs, the load on the remaining individual fibres increases and an abrupt extension takes place. The curve is smooth only because of the very large number of fibres involved. The final, almost straight, portion may be attributed to frictional resistance between the separating fibres. At any point on this portion, had loading been stopped, the trace would have taken a vertical direction and the breakage slowly proceeded to completion. Since the loading is continued, the trace is drawn out of the vertical, but to an extent decreasing as the fractures become more complete.

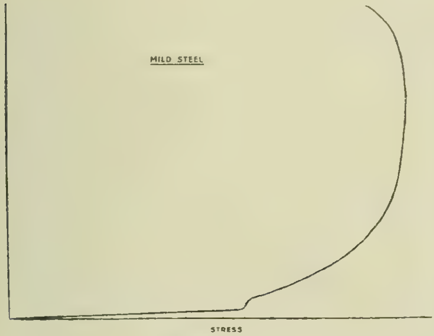


Figure 3

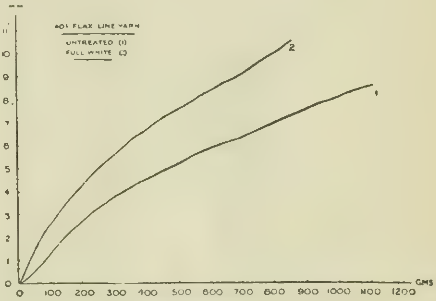


Figure 4

The curve obtained from a cotton yarn shows well-marked peculiarities as compared with the flax curve. The initial portion shows a decreasing slope, indicating a tightening of the fibres and an increase in frictional resistance to their relative motion. Later, however, the slope begins to increase again, until breakage occurs, a feature not usually to be observed with flax and similar yarns.* In the case of cotton the extensibility decreases to a minimum value, and from this point onwards the relative motion of the fibres leads to configurations which are more and more easily disturbed. The properties of the individual fibre are, at this stage, of predominant importance. The many convolutions give it a spring-like character, and increased extensibility. The fact that the change in angle of slope is smaller than is the case with flax yarns may be due to the existence of a smoother surface on the cotton fibre. This would reduce the alteration in frictional resistance which takes place as the fibres are pulled into closer contact. The final portion of the curve, in which the slope is progressively increasing, in contrast with the decreasing final slope of linen, hemp and ramie, is very interesting. A test piece of yarn, the length of which greatly exceeds the staple of its component fibres, will break for one or both of the following reasons. Either the total static friction between the fibres in a particular portion of the piece becomes less than the applied tension, or, the force being fully transmitted by the firmly interlaced fibres, a point is reached where one or more of the individual fibres are unequal to withstanding their share of the stress. Their fracture renders probable further breakages in the neighbourhood, and a complete severance may occur. Both factors probably operate to a varying extent in all yarn breakages. From the nature of the two phenomena, it is probable that severance by slipping will occupy a longer time-interval than a severance due almost entirely to fibre fracture. Now the cotton curve, in gradually approaching a vertical direction, seems to indicate a slow and progressive dismemberment. The flax curve, tending to a direction less and less vertical, followed by a sudden change at breaking point, would seem to indicate a very sudden disruptive process. One is led to the conclusion, therefore, that in the case of cotton yarn fractures, slipping is a prominent feature; while in flax, ramie and hemp, the breakdown of the fibres or of the bundles of fibres is the chief cause of severance.

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*A curve showing increasing steepness as the breaking point is reached has, however, been obtained from a specimen of flax tow yarn that had been soaked in water for an hour previous to testing. In this case the forces opposing the relative motion of the fibres have, on the above theory, been reduced, so that slipping occurs more freely.

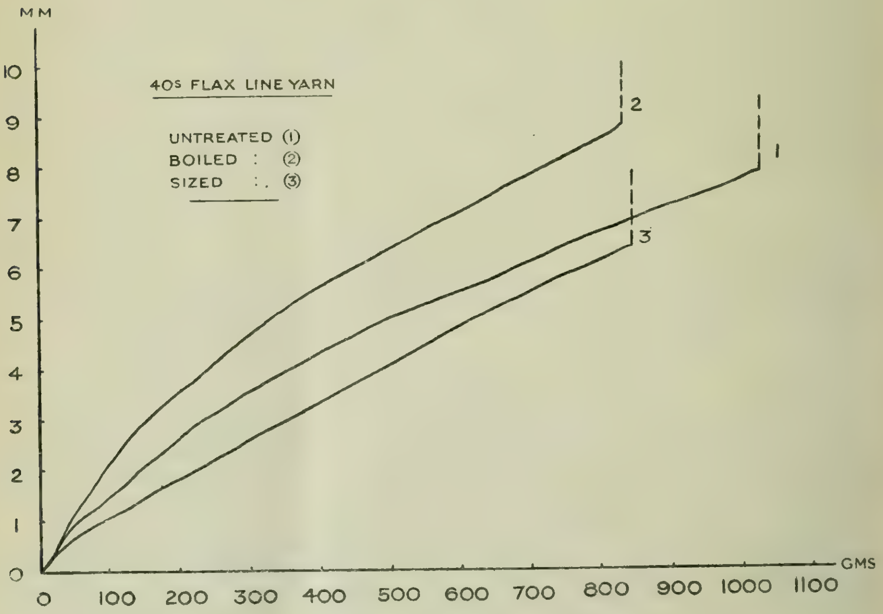

Figure 5

The worsted yarn will be seen to exhibit the same general characteristics as the cotton yarn. On account of the great extensibility of the worsted yarn, in order to get a curve of convenient size, when examining this yarn a test piece 70 cms. in length was used. Instead of 10 times the extension being recorded, by clamping the lower end of the yarn to the pen carrier, the vertical displacement of the pen was made to equal the actual yarn extension. In reading this curve, therefore, the graduations must be regarded as centimetres, instead of millimetres as for the others. This treatment, while not changing the relations between the successive portions of the curve, renders the peculiarities more obvious and facilitates comparison with the other curves. Both cotton and worsted yarns give curves closely allied with the steel curve in the final portions, the extensibility in all three cases increasing as the breaking point is reached.

In Figure 4 are shown the mean curves, from 10 tests of untreated 40's line flax yarn, wet spun, and from 10 tests of samples of the same yarn after full bleaching. This diagram cannot show the behaviour immediately preceding fracture for the reasons previously mentioned. In no instance, however, was any point of inflection observed near the end of the bleached yarn curves. The removal of the considerable proportion of cementing material from the untreated yarn, in this case amounting to 23 per cent. of the original weight of the yarn, has resulted in a noticeable increase in extensibility at all stages of loading, but the final fracture is still abrupt.

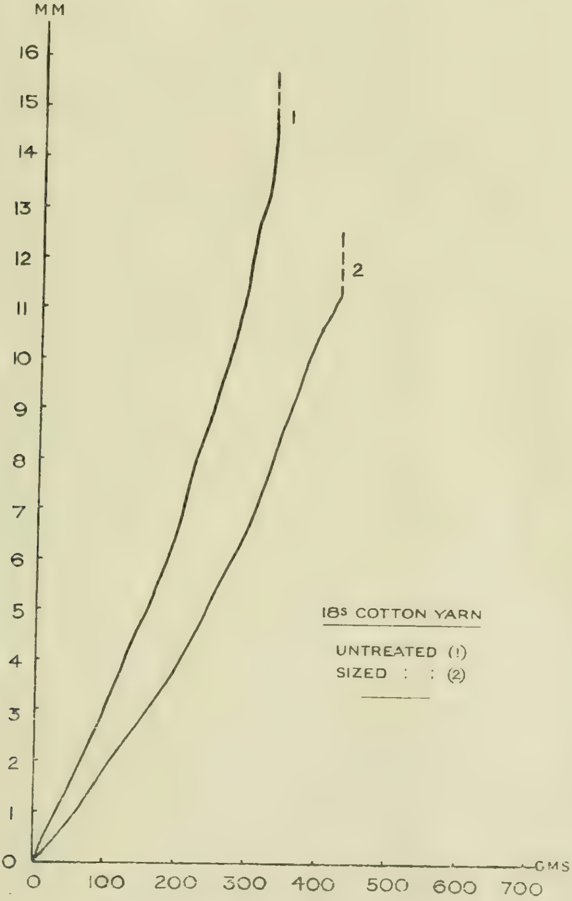

Figure 6

The initial downward convexity of the curve from untreated yarn as opposed to the steep beginning of the bleached yarn curve, indicates that the presence of pectinous matter may be the cause of the greater initial resistivity to extension mentioned above.

The next Figure (5), which shows the effect on the yarn of the operations of boiling and sizing which precede weaving, should be read in conjunction with Figure 4. Here typical examples have been selected from groups of at least 10 curves in each case. The boiling and dressing operations were carried out in a manner closely corresponding with manufacturing practice in the North of Ireland. The boiling, effected in a weak alkaline liquor, has changed the elastic properties of the yarn almost as much as the complete bleaching, which involved a more drastic chemical treatment. The subsequent sizing has reduced the extensibility to even less than its original value, and, in addition, has made it almost identical at all stages of the application of tension. Such alterations in characteristics have a most important bearing on the weaving qualities of a yarn.

The size appears to inhibit any great change in extensibility, possibly through its cementing action being more complete than that of the pectinous matter in the " green " yarn. In the sized yarn the single fibre is a far more common unit, the fibre bundles probably being disintegrated to a certain extent by the boiling process, and each free fibre is probably embedded in starch. On applying tension, therefore, no great alteration in relative position is possible transversely. In untreated yarn appreciable interstices probably exist between the fibre bundles. These are obliterated when tension is applied, and the frictional forces opposing relative motion of the fibres increase.

The behaviour of cotton yarn when sized is given in Figure 6, which shows a similar decrease in extensibility accompanied by a slightly more abrupt breakage. Whether the final severance has resulted from size fracture or fibre fracture is not deducible from the graphs.

The following Figure (7) shows mean curves from flax yarns of various counts, all being made from the same batch of Courtrai fibre. The twist is in all cases $1{\cdot}75\ \sqrt{n}$ turns per inch, where n is the lea number. It will be noticed that, in general, the extensibility of a yarn increases with its fineness, a feature obviously to be expected. This system of fixing the twist to be given to a yarn, by the root of the lea number, gives to the exterior fibres in all counts the same angular deviation from the axial direction. Whether or not such an arrangement makes the best possible use of all the fibres in the cross section is a promising field for enquiry. At present, all that can be said is that it is a standard manufacturing practice. Were it certain that, in each of the yarns here dealt with, the twist was exactly sufficient to produce the same effect, fibre per fibre, then the divergencies between the different curves would be attributable to the differences in weight alone. At present, the varying twist must be assumed to have influenced the curves in a manner unknown, but probably small in extent.

Figure 8 is interesting in this connection as it shows how important a factor is the twist of a yarn. This diagram shows the behaviour of four yarns made from the same material and having the same weight per unit length, all being 40's lea. The differences observable in the shapes of these stress-strain curves must therefore be due entirely to the differing twists. At all loads the extensibility increases with increasing twist. The contrast in slope is, however, most noticeable at small loads. This is probably because at the early stages of loading, in the case of all yarns, the looser packing of the fibres and the fibre bundles renders the spring-like properties conferred by twist less obscured by the frictional effects between adjacent units. The downward convexity of all four curves at their initial portions is very noticeable. The increasing extensibility over this region of very minute loads, as mentioned above, must be due to some decreasing resistance, possibly of some pectinous structures which are progressively ruptured.

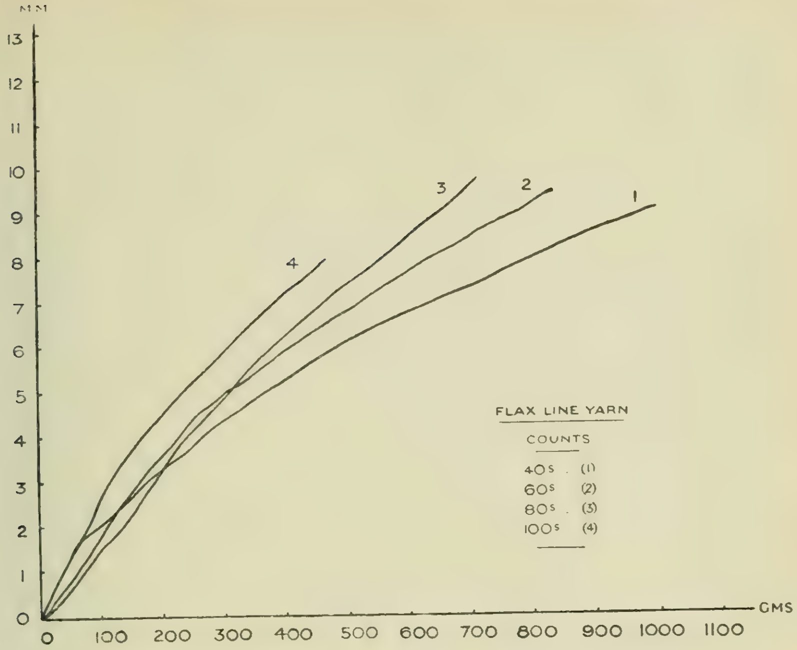

Figure 7

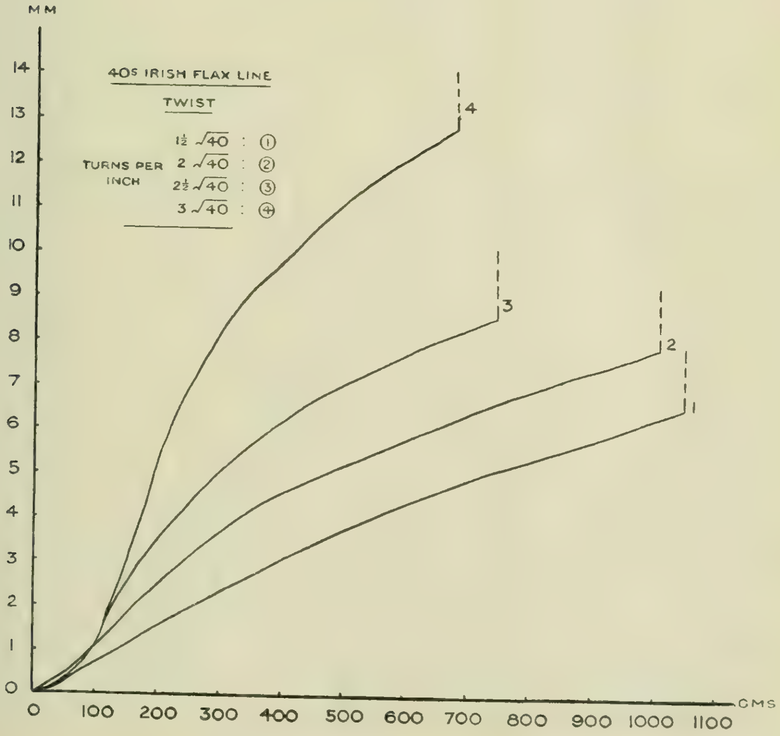

Figure 8

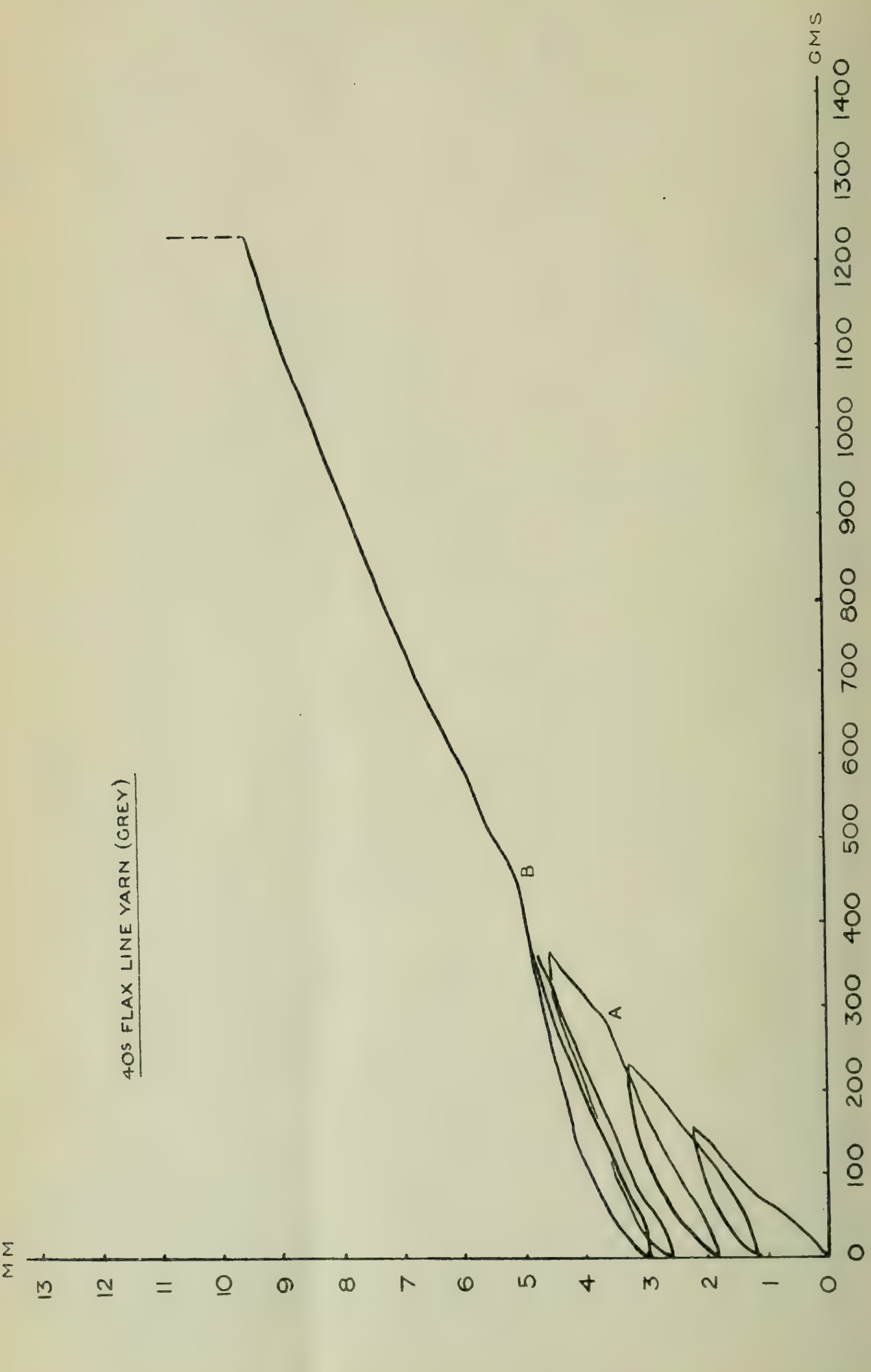
40S FLAX LINE YARN (GREY)
MM
0
1
2
3
4
5
6
7
8
9
10
11
12
13
GMS
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
A
B

Figure 9

The properties of this constituent are very probably greatly influenced by the conditions under which the yarn is dried after reeling; the tension on the yarn, the temperature and humidity of the drying chamber atmosphere, the variations in rate of drying at different stages of the operation, etc., are all factors whose influence and importance in connection with the properties of a wet-spun yarn have yet to be investigated. It will be noticed that the curve from the yarn with least twist quite soon approaches practically a straight line form, indicating that the settling or compressing process in this case very soon approaches the limit of its influence. As the twist is increased, this phase becomes progressively nearer the breaking point, until, with twist equal to $3\sqrt{40}$ turns per inch, the trace has a pronounced curvature right up to the fracture. In this case, then, rupture has occurred at a stage in tensioning operation, when an appreciable increase in resistivity to extension would, apparently, still have been possible. The theory of the mechanism of yarn breakages outlined above provides an interesting explanation of this feature. Since the slope of the curve is still in process of decreasing at the breaking point, on that theory, the severance is due mainly to fibre fracture, the influence of this factor apparently increasing as the twist is increased. From breaking strength determinations it has been found that the highly twisted yarn is the weakest of the group. This tends to confirm the above explanation, since in a highly twisted yarn the forces acting on a section of a fibre in the direction of its own axis must be greater than in the case of a slightly twisted yarn, in order to give the same component force in the direction of the axis of the yarn. Under the same yarn tensions, therefore, the fibres in the highly twisted material will be subjected to a greater individual tension. It is probable also that the intrinsic tensile strength of the fibre decreases as the twist is increased. Another point to be observed in Figure 8 is that the difference between the curves from the yarns of the two highest twists is much greater than other corresponding differences. Some critical point is here indicated in the resultant influence of the beneficial and deleterious effects due to the twist, as this changes. The complete explanation of these phenomena will not be possible until detailed knowledge is available of the fundamental physical properties, such as longitudinal elasticity, torsional rigidity, and friction co-efficients, of both fibres and cementing matter.

Hysteresis curves, as might be expected, promise to yield, in conjunction with other knowledge, considerable information on the structure and properties of a yarn. From the practical point of view, they should give some indication of the probable reaction of the warp to the forces applied to it in the loom, although, in the loom, the cycle is completed in a much shorter time than is taken to produce these diagrams.

Figure 9 shows the trace obtained when a flax yarn is subjected to successive cycles of loading and unloading; in increasing steps in the first three instances and, after that, to an identical maximum load. It was found that, after five repetitions, the curves obtained were co-incident, the yarn having attained a cyclic condition. The seventh, and final, repetition of cycle No. 3 is reproduced. Among the many important inferences to be drawn from the shape of this curve may be mentioned the rapid increase in slope as the unloading approaches completion. This, indicating, as it does, a greater power of recovery from the effects of stresses, under small loads, is probably attributable to the same cause as the slight downward convexity of many of the curves at the commencement of loading. The permanent set of the yarn after it had been subjected to any cycle may be due to (*a*) permanent elongation of the fibres; (*b*) permanent decrease in radius of the yarn and of the spiral configurations of the fibres; (*c*) longitudinal slipping of the fibres. In all three cases a permanent deformation of the pectinous matter is entailed. It is difficult at present to distinguish with certainty, between the effects, as shown in the curve, of the various occurrences in the yarn. It is evident, however, that when the yarn is in

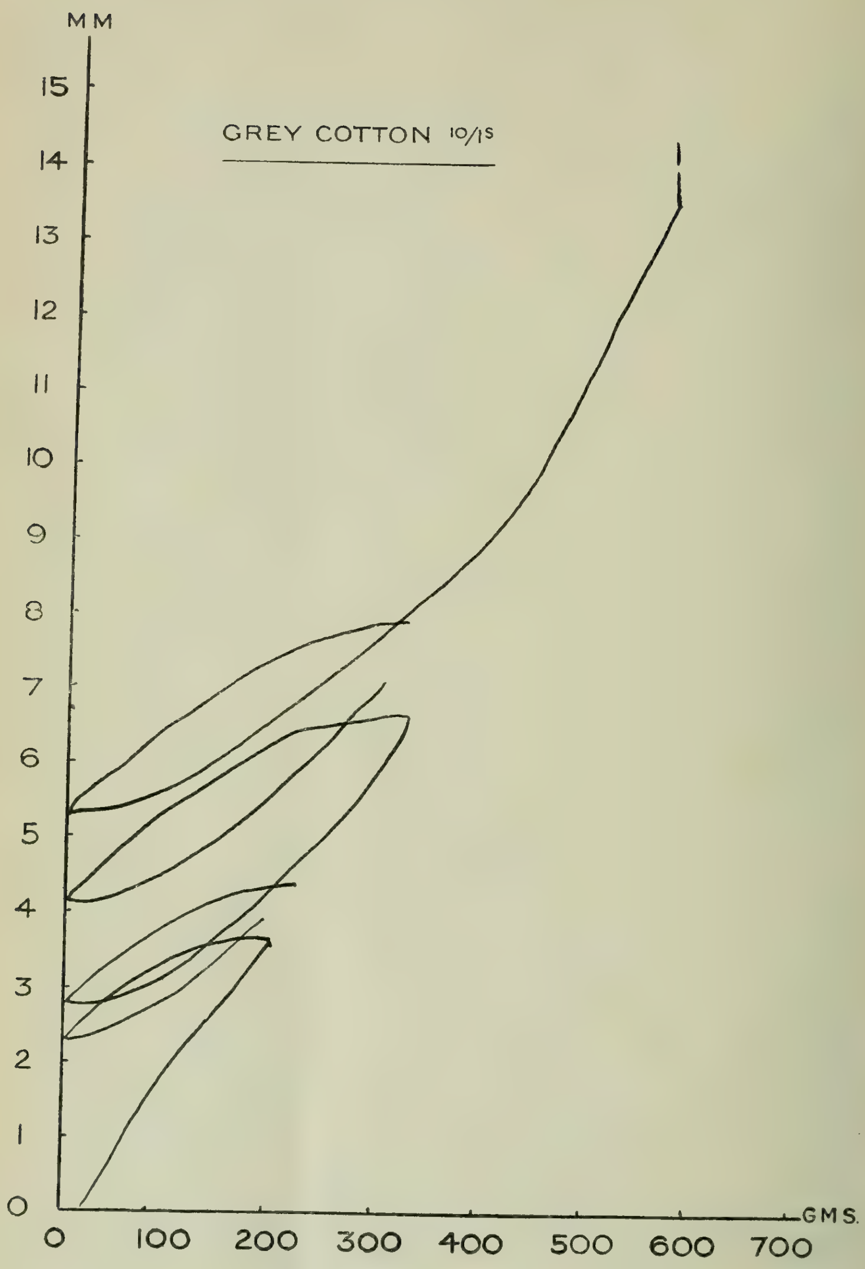
MM
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
GREY COTTON 10/1s
0
100
200
300
400
500
600
700
GMS.

Figure 10

the cyclic condition, all changes taking place in its constitution being reversible, any slipping of the fibres is improbable. The elongations which are then observed are probably attributable wholly or mainly to the resilient properties of the fibres and of the binding material. The points of inflection observable at A and B would seem to indicate the recommencement of irreversible changes in the constitution of the yarn.

A hysteresis curve for a cotton yarn is shown in Figure 10. A strict comparison between this and the previous diagram would not be justified, on account of the different weights of the two yarns. A difference which is probably not connected with the weights, however, is observable in the comparatively slow attainment of the cyclic condition with cotton. This particular sample of yarn has never completely reached the cyclic condition, although as many as 25 repetitions of a cycle have been made on a test piece from it. With loads which are small compared with the mean breaking strength, however, a definite approach to coincidence has been noticed in the loops after twenty cycles. At greater loads, this tendency is not always observable, the rupture of the yarn apparently being a certainty if the cycle is repeated for a sufficient number of times.

Hysteresis curves from sized yarns, both linen and cotton, have been examined. The loops are of considerably smaller area than those from the same cycle in the case of the grey or unsized yarns, a point of great practical and theoretical importance.

Having regard to the complexity of structure of a piece of yarn, it is a matter for surprise that the stress-strain curves show any trace of systematic change under varied conditions. With yarn, one has a structure, the components of which show every possible variation in length and thickness, assembled in the rough and, to a certain degree, haphazard conditions imposed by industrial demands, reacting to applied forces in a remarkably consistent and orderly fashion. The large number of the units forming the test piece is, of course, a favourable factor. Another feature which conduces to uniformity in the elastic properties of yarn is the manner in which its units are inter-connected—simply by frictional and compressional forces acting over practically their whole surface.

The relation between the mean length of the unit components and the length chosen for the test piece is also of importance. In practically all the curves given in this paper, it is certain that the test length is greater than the mean staple length. When the former is reduced to less than the staple length, some very interesting comparative results should follow, particularly in connection with wet spun yarns. In spinning these yarns a drawing and a sub-dividing process operates on the rove in the wet state, but to what extent the effects of this process persist in the yarn, and how subsequent properties are influenced by it, are points about which little is known. Experimental work in connection with this question is in progress, and it is hoped to deal with it in a later communication.

SUMMARY.

A machine which gives autographic stress-strain records from yarns is described, and an account is given of results already obtained with it.

The probable errors in the curves obtained are discussed, and the methods available for presenting the curves are reviewed. It is concluded that the selection by inspection of the most typical curve from a series obtained with the same yarn is a suitable method for the purpose of a general discussion.

A typical group of curves from a flax yarn is shown, and the uniformity and other characteristics exhibited by the group discussed. Curves are shown also from various textile materials, and are compared with a stress-strain diagram from a specimen of mild steel.

Curves indicating the influence of various factors, such as weight, twist, boiling, bleaching, sizing, on yarn behaviour are demonstrated.

From the character of the terminations of the curves, a theory as to the mechanism of yarn fractures is developed.

Representative hysteresis curves from a linen and from a cotton yarn are given and discussed.

(Received 19th January, 1922.)

WOOL ANALYSIS OF A FLOCK OF HIGHLAND BLACKFACED SHEEP.

By Aldred F. Barker, M.Sc. (Professor of Textile Industries
in the University of Leeds).

During the month of September, 1920, I was asked by Professor J. Cossar Ewart, University of Edinburgh, to examine carefully the wools of a number of sheep from a typical blackfaced flock. Permission having been obtained from Mr. Alex. Cawan, of Valleyfield, near Penicuik, a visit was made to his Eastside farm (September, 1920), and a number of samples were taken from selected sheep. These samples, along with shoulder wool taken from two of the best rams coming under the hammer at the Perth Blackfaced Ram Sales (1920), form the basis of this report.

The list on page 41 records the results of the examination of these wools. It should be noted that the lengths are "September lengths," and are only of relative value

Length Analysis.—The longest wools are Nos. 9, 10, and 11—naturally coming from lambs; then come the rams Nos. 1 and 12 (a); then the shearling ewe No. 8; and, finally, the "aged" ewes. It would thus appear that the longest wools are from the lambs, but this is probably due to the one or two months' extra growth as compared with the shearlings; then the shearlings, which relatively seem to approximate to the lambs, with a marked falling off in length, and probably weight also, for the older sheep. The speckled-faced (brocket) ram (Nos. 12 and 12a) shows a remarkable difference in length between shoulder and haunch wools. This is a defect which ought to be bred out. It is very interesting to note how much shorter the fine fibres usually are than the coarse fibres. This accounts for the remarkable form of the "staples" shown in Fig. 1. Incidentally, also, it may be remarked that this shortness explains why the "noil"[1] of blackfaced wool was so much sought after during the war period for the making of relatively fine goods.

It would seem desirable that further investigation should be carried out on the following points :—

(*a*) What effect on the health and stamina of the sheep has the growth of a large proportion of short fibre and a small proportion of long, strong fibre, as against a large proportion of long, strong fibre and a small proportion of short, fine fibre? And

(*b*) What additional value does a large proportion of short, fine fibre add to the fleece from the manufacturing point of view?

Diameter Analysis.—It will be noticed that with the exception of Nos. 1, 1a, and 12a there is a remarkable relationship between length and fineness of fibre, which is emphasised as follows :—

Coarse Fibres.					Fine Fibres.			
Lengths.		Diameters.			Lengths.		Diameters.	
Max.	Min.	Max.	Min.		Max.	Min.	Max.	Min.
8·4	3·2	$^1/_{260}$	$^1/_{599}$	....	2·8	1·45	$^1/_{680}$	$^1/_{960}$

Thus it would appear that there is usually a definite relation between length and fineness—that the longer fibres are the coarser and the shorter

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[1] Noil is the short fibre combed from the long fibre, the long fibre forming "top."

RESULTS OF EXAMINATION.

SAMPLES FROM EASTSIDE (MIDLOTHIAN) SHEEP, Taken September, 1920.

TYPE.	Coarse Fibres. (Inches)		Fine Fibres. (Inches)		Average Length	Average Diam.	Proportion		Proportion Dark	
	Length	Diam.	Length	Diam.	of the whole staple.		Coarse	Fine		
1.—18 months ram, fine type shoulder (from £70 old Cleggan ram)	6·95	1/370	3·5	1/900	5·225	1/635	60%	40%	2%	
1a.—18 months ram, fine type haunch	6·7	1/470	3·8	1/925	5·25	1/697	70%	30%	1%	
2.—6 year old white nose, curly	3·4	1/447	1·7	1/950	2·55	1/698	70%	30%	—	
3.— ,, ,, straight and coarse	3·55	1/260	1·45	1/830	2·5	1/545	85%	15%	—	
4.—5 year old standard	3·8	1/363	1·6	1/920	2·7	1/641	65%	35%	—	
5.— ,, strong type, shoulder	4·15	1/367	1·75	1/880	2·95	1/623	75%	25%[2]	—	
5a.— ,, strong type, britch	4·1	1/363	1·55	1/873	2·82	1/618	80%	20%[2]	—	
6.—5 year old speckled (present day type)	4·05	1/478	2·15	1/920	3·1	1/699	75%	25%	60%[1]	
7.—5 year old ewe (present day type)	3·2	1/546	2·2	1/880	2·7	1/713	60%	40%	—	
8.—18 months ewe	5	1/383	2·75	1/880	3·87	1/631	80%	20%	—	
9.—Ewe lamb, shoulder (medium, present day)	8·4	1/599	2·8	1/950	5·6	1/774	65%	35%	—	
9a.—Ewe lamb, britch	8·25	1/498	2·05	1/920	5·25	1/709	70%	30%	—	
10. ,, shoulder (soft patch)	8·35	1/502	2·05	1/960	5·2	1/731	60%	40%[2]	—	
10a. ,, britch	8·15	1/468	1·95	1/820	5	1/644	80%	20%	—	
11. ,, shoulder (very grey)	7·95	1/419	2·1	1/873	5·02	1/646	75%	25%	30%[3]	Opaque
11a. ,, britch	7·7	1/393	1·85	1/680	4·77	1/536	80%	20%	10%[4]	
12.—18 months speckle-faced ram, shoulder	4·5	1/413	2·8	1/873	3·65	1/643	55%	45%	—	
12a. ,, ,, haunch (present day type)	7·4	1/314	3	1/880	5·2	1/597	70%	30%	—	

SAMPLES FROM SPECIAL RAMS (PERTH FAIR, September, 1920).

TYPE.	Coarse Length	Coarse Diam.	Fine Length	Fine Diam.	Average Length	Average Diam.	Coarse	Fine	Proportion Dark
£200 lamb ram	8·1	1/423	2·75	1/940	5·425	1/676	60%	40%	—
£700 shearling (shoulder wool)	8·05	1/154	2·8	1/746	5·425	1/450	80%	20%	some

[1] No fine dark fibres.

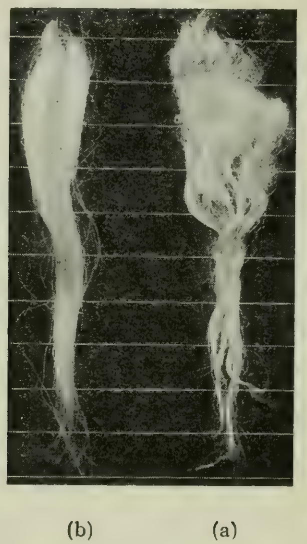
[2] Fine fibres slightly lustrous.

[3] All dark fibres are fine.

[4] Some dark fibres are coarse.

fibres the finer. That this is usually so, both in the British Isles and elsewhere, is shown by the fact that the diameter of the fibre is the basis of wool "quality," and unless there were a reasonable relationship between fineness and length this mode of estimating "quality" would be very unsatisfactory.[2] The average diameters give a correct idea of the average fineness of the fleece, but, upon the whole, it would seem preferable to consider the short and the long fibres separately.

FIGURE 1.



(a) Open-grain fleece.
(b) Close-grain fleece.

Proportion of Coarse and Fine Wools.—This may be a most important matter both from the point of view of the health of the sheep and the value of the fleece to the manufacturer. Judging by No. 3, coarseness of fibre and quantity of coarse fibre would appear to run together. This suggestion is further supported by the fact that No. 10, the finest fibred wool, also gives a large proportion of fine wool (40%). These percentages, however, are only estimated from the staples, and must not be regarded as absolutely exact. It is interesting to note that in Nos. 5, 5a, and 10 the short fibres appear more lustrous than is usually the case. This would naturally suggest the possibility of the development of lustre wools (Lincoln, Leicester, Wensleydale, etc., etc.) from the more lustrous of the comparatively non-lustrous mountain breeds.

Dark Wool.—Observations on the dark fibre taken along with the white show that in some cases the dark fibres are always coarse, and in other cases all the dark fibres are fine. In Austria the people have the idea that the dark or brown wool is the finer, but elsewhere it is usually considered to be the coarser. The fact seems to be that, so far as the blackfaced breed is concerned, the fleece may be either coarse or fine fibred, and possibly both in the same fleece, although there is only one sample (No. 11a) of the mixed in this set of samples. It is unfortunate that the £700 shearling ram should not only grow dark fibres but that these change in colour, often being brown at the tip and white at the root. All the coloured fibres in the Eastside wools are solid throughout.

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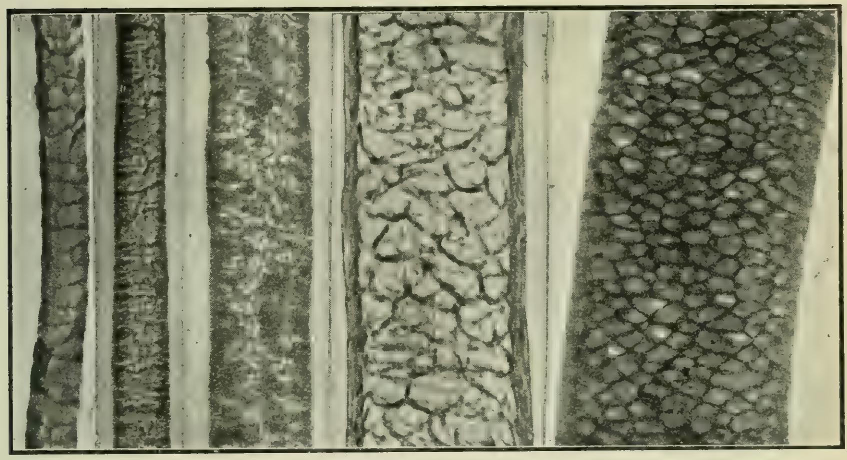
[2] Mr. H. Wilkinson gives the formula for fibre diameter as $\frac{1}{q1{\cdot}52^{1{\cdot}6}}$ where q is the Bradford quality number.

Scale or Cell Markings.—Careful examination by several reliable workers has led to a somewhat interesting deduction. The view that the existing wild sheep have two coats—one of coarse hair showing cell structure and the other of fine wool showing scale structure—is undoubtedly correct, but observations made on the wool samples in question and upon certain other wools tend to suggest strongly that in the case of the normal sheep living under domestic conditions, where nature does not weed out the wool and leave the hair (as in certain African breeds), or weed out the hair and leave the wool, there is a tendency to grow both coarse and fine fibres with a cell structure between hair and wool—neither the one nor the other. Along with this nondescript fibre will be found strong fibres with the hair " mosaic cell-structure " and fine fibres with the wool " scale-structure." There would appear to be some relationship between the scale structure and the fibre diameter (the diameter being here some sort of a measure of the size of the cells or scales). It would also appear that, as there is a relationship between fibre diameter and the fibre length, the development of long lustre wools and of short curly wools is thus reasonably explained. In Fig. 2 (*a*) is shown the structure of blackfaced wool of the nondescript type; in (a′) the thickening of the fibre and the change to hair, the " cell " or mosaic structure being

FIG. 2.



A—Malico polo-hair.
a′—Eastside blackfaced hair.
a ,, ,, nondescript.
a″ ,, ,, changing towards wool.
a‴ ,, ,, wool.

clearly perceptible; in (a′′) the thinning of the fibre and the change towards wool; and in (a′′′) the completed change to a really typical wool fibre, clearly showing the surface scale markings. Careful examination of these and other wools also suggests that there is some relationship between thickness of fibre and depth of growth from the skin. This matter should certainly be investigated. It is interesting to note that recent research is tending more and more to eliminate the scale structure as a factor in felting, while at the same time emphasising the stability of the wool fibre.

Note should be made that there is a curious variation in the opaqueness of the thick fibres from different fleeces. These " lack-lustre " fibres are quite common in Lincoln wools and other lustre wools, being regarded as a type of fibre to be " bred-out " at all costs. They are probably " throw-backs " to an ancestral type of British mountain sheep.

Perth Prize Rams.—The particulars given of the two prize rams shown at the September Ram Sales, Perth, are worthy of most serious consideration. That such a sum as £700 should be paid for a ram carrying such wool as is indicated by the analysis is beyond words. Unfortunately, the tendency to select the strong-haired type is only too fashionable, and unless a change in this respect takes place, and that quickly, blackfaced wool will be unuseable save for carpets and the very roughest styles of fabrics. The small percentage of bottom wool fibre emphasizes the disadvantage, as does also the presence of black hairs and the apparently inevitable kemps. The density of the staple appears to be obtained at the expense of the " curl " or waviness, and this again is disadvantageous from the manufacturing point of view. The £200 lamb ram gives a much better reading, and it is to be hoped that fleeces of this type will be more favoured in the near future.

Important Deductions.—The following suggestions should be carefully considered by breeders of Blackfaced sheep :—

(1) The ultimate value of fleeces will be markedly improved by breeding for fine bottom wool rather than for the coarse long hair wool. No. 1 is typical in this respect, and is from a fleece incomparably better, from the manufacturing point of view, than the fleece of the £700 shearling ram.

(2) Whether breeding for the long coarse hair or the short under wool, brightness and lustre rather than opaqueness should be aimed at. Thus, Nos. 5 and 10 tend towards the lustre type of wool, while No. 11 tends towards the dull opaqueness type of a very unsatisfactory character.

(3) It is quite conceivable that two types of really useful fleeces might be bred from the heterogeneous present-day blackfaced sheep : (*a*) Long fibre of the lustre type, with little bottom wool; (*b*) short wool of the bright type, with little or no long fibre. Of these two, the latter (*b*) would probably be worth two to three times the value of the long fibre forming the outer coat. From the manufacturing point of view, it would certainly be very advantageous to have the above two distinct types only, rather than the miscellaneous array presented by so many of the existing flocks of blackfaced sheep.

(4) Although it is usually considered that a level blackfaced sheep is more likely to have black hairs interspersed throughout the fleece than a spreckled faced, or brocket, this is not borne out by No. 6, which is a spreckled face carrying about 60% coarse dark fibre. Every possible endeavour should be made to eradicate black or coloured hair of every description, and it would seem to be possible to do this and yet retain the characteristic black face; but most careful selection will be necessary.

(5) Kemps should be eliminated at all costs or a specially kempy wool occasionally bred to meet the vagaries of fashion and the demands for wool for making up into " homespuns."

When speaking to the Scottish sheep breeders at Perth, I questioned the value of any type of blackfaced wool, and went whole-heartedly for the Southdown cross. But to-day, after careful examination of the Eastside samples, I cannot deny the possibilities of very markedly improving blackfaced fleeces, and I hope that the Scottish Board of Agriculture will discover some means of ensuring that Scottish farmers of the progressive type shall be encouraged and helped to produce the two types of fleeces just defined above, which probably will give both farmer and manufacturers the best possible financial return.

My thanks are specially due to Mr. D. P. Stewart for many arduous hours of work in examining and measuring the wool staples and fibres under consideration.

(Received 23rd December, 1921).

THE ELASTIC PROPERTIES OF YARNS

PART I.

By J. A. Matthew, M.Sc. (Lond.), A.R.C.S., F.Inst.P.

In the course of investigations, extending over several months, on the elastic properties of flax yarns, results have been obtained which appear to be of general interest, especially as in some respects they differ very considerably from those obtained by E. A. Fisher—Article IV. of " The Interpretation of Quantitative Experimental Results in Textile Research " (this Journal, Vol. XII., No. 10, October, 1921)—who worked on wool.

The results communicated in the present paper are derived from the examination of flax chiefly, cotton and hemp also having been tested for comparison, but not wool, and they show that the nature of the individual fibres composing a yarn largely influence its elastic properties.

I.—TESTING MACHINE.

A testing machine was constructed to record graphically the elongation of yarns under constantly increasing or decreasing loads. This machine, shown complete in Diagram 1A, with the recording part in detail in Diagram 1B, was based upon the Autographic Wire Tester devised by Prof. A. Barr, F.R.S., as regards the autographic recorder.

The recording apparatus consists of a drum revolving on screw points and a long cylindrical spring, the top end of which is fixed. The lower end is fixed to a cord which passes down and under a pulley, once round the drum pulley and over a second pulley to a small weight. Hence any extension of the spring is communicated in equal amount to the drum, so that the circumferential movement of the drum is proportional to the load on the spring. In front of the drum are two guide rods with a slide carrying the pen.

Parallel to the pen guides is fixed a slotted guide for a metal plate made with bevelled edges to reduce the bearing surfaces to a minimum. At the top of this plate is a clamp for fixing the lower end of the yarn, the upper end of which is held in a fixed clamp. To the bottom of the plate is fixed a cord which passes under a pulley and up to the lower end of the cylindrical spring.

The load is applied to the axis of this pulley, so that the applied load is equally divided between the spring and the yarn. The loading system comprises a 5 :1 lever, actuated by water running at a constant rate into the vessel suspended from the end of the lever. Provision is made for emptying the vessel from the bottom.

The elongation of the yarn is communicated to the pen magnified four times in the present machine by a lever fulcrumed between the two guides. The top edge of the lever bears against cylindrical pins fixed in the centres of the yarn plate and pen slide; to minimise friction between the slides and the guides, the bearing edges of the lever are curved in such a way that the thrusts between the pins and the lever are always vertical. The curves forming the bearing edges of the lever are obtained by a graphical method, and the design is completed by making it balance about its point of suspension.

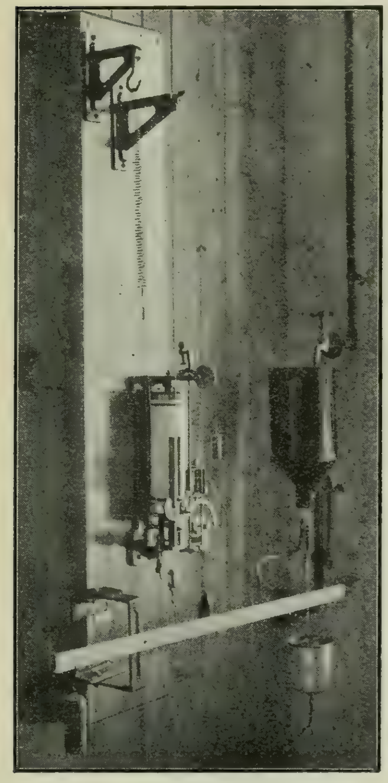


Diagram 1a.

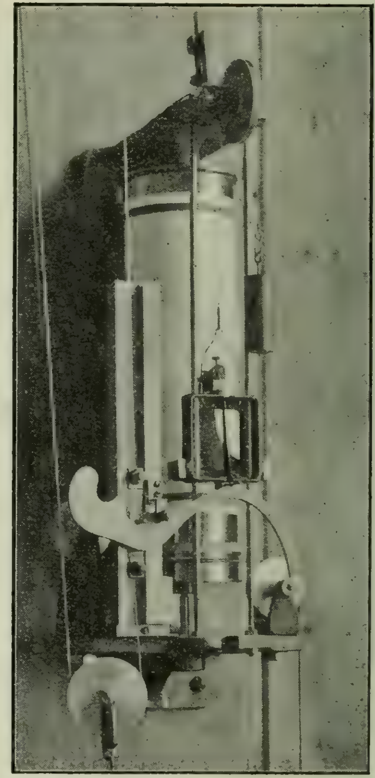
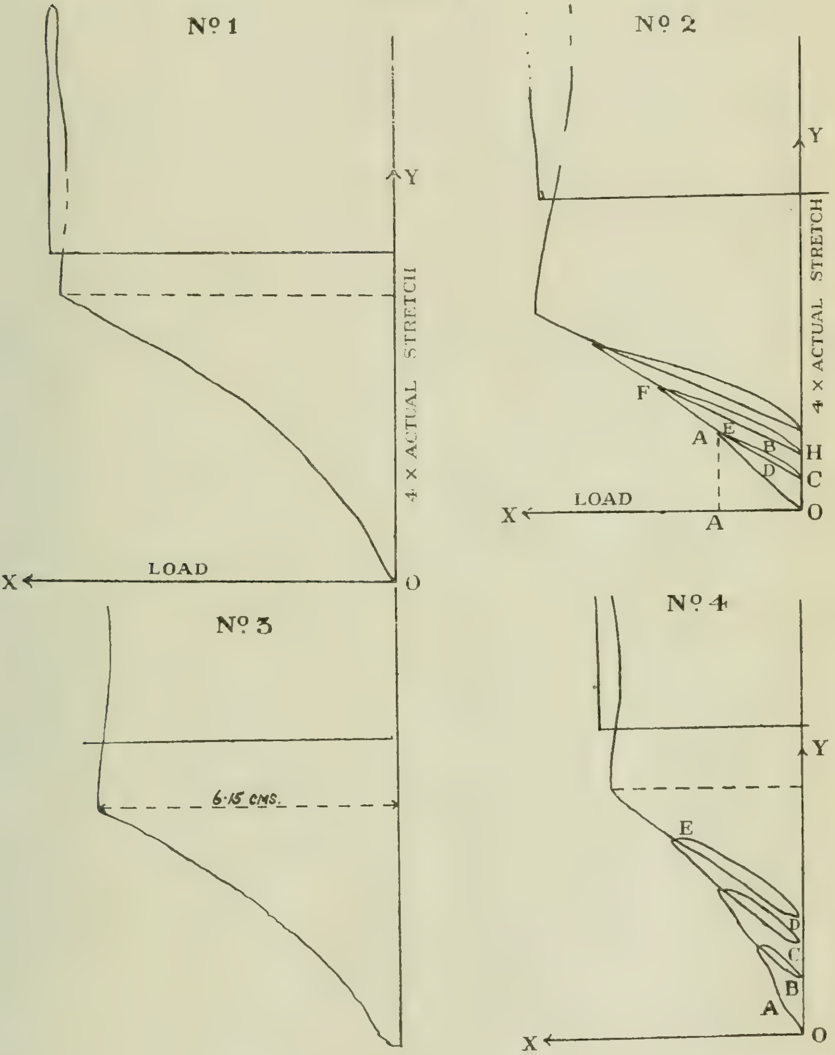


Diagram 1b.

The loading lever system is first balanced; the pen slide is separately balanced by a counterpoise arranged to allow of a very slow fall of the pen slide down the guides, in order to ensure contact between the lever and the pen slide whether the lever is rising or falling. The weight of the yarn plate has not been balanced, all the tests being carried out, therefore, with an initial tension on the yarn equal to the weight of this slide less four times the unbalanced weight of the pen slide. This yarn-plate could be counterpoised, and then any desired degree of initial tension put on the yarn.

The loading and recording systems are then connected by the cord passing around the pulley from the bottom of the yarn plate to the cylindrical spring; this cord is adjusted in length to have the loading lever and magnifying lever both horizontal, with the yarn in the initial condition.

Diagram 2.



To carry out a test, the yarn is clamped at both ends, the pen placed in contact with the paper on the drum, and the pen slide moved on its guides to draw a zero vertical line. The nozzle controlling the rate of flow from the constant head reservoir is held over the vessel suspended from the end of the lever. As the loading proceeds, the drum rotates at a constant rate proportional to the load, and the pen rises by an amount equal to four times the elongation of the yarn, so that the pen automatically records a load-stretch diagram. By swinging the nozzle to one side and opening the clip on the rubber tube below the vessel, the load can be removed, but not at a constant rate, owing to the constantly diminishing head of water. The process can be repeated as often as desired, and finally the yarn can be carried up to the breaking point. By measuring the volume of water in the can when the test is stopped, the load scale on the diagram is determined.

This apparatus has been found to work very satisfactorily, the main point being to keep the slides clean and well lubricated. Any friction on these parts is at once visible on the diagrams, as will be shown. The rate of loading and the length of the test piece may be varied at will; also, the magnification can be altered to suit the class of work. In the work to be described, the test length was 30 inches and the rate of loading 200 ccs. per minute from the nozzle, which is equivalent to 17·6 ozs. per minute on the yarn.

II.—THE LOAD-STRETCH DIAGRAM.

Diagram 2 shows reproductions of various typical load-stretch diagrams obtained on this machine.

No. 1.—At O the yarn is stretched under its small initial tension, and as the load is uniformly increased the pen recorder traces out the curve OB. At any point on this curve, distances parallel to OX are proportional to the load and distances parallel to OY are equal to four times the actual stretch of the yarn. When this specimen ruptured at B there were 620 ccs. of water in the vessel, hence the load on the yarn was 54·6 ozs.; AB = 7·45 cms. so that on the diagram, each cm. along OX corresponds to a load of 7·35 ozs.

When the yarn breaks, the yarn plate falls rapidly, giving an impulse to the pen and, owing to its freedom, it rises rapidly on the guides and then gradually falls back into contact with the lever, and when the load is removed from the loading lever the drum returns to its original position, and the pen traces out the continuous horizontal line shown.

No. 2.—In this case the application of load was stopped at A and gradually reduced to zero, and this repeated three times before rupture of the yarn occurred.

Experiments have been made to determine how the characteristics of these diagrams are altered by inefficient working of the machine. It is found that whilst the main characteristics of the diagrams remain unaffected, friction on the slides and at the bearings of the recording drum introduce changes which can at once be detected, and the fault remedied. Thus Nos. 3 and 4 illustrate the diagrams given when friction is introduced by leaving the machine out of use and unprotected from dust for some time.

No. 3 shows the effect of friction on a curve of type No. 1. The yarn does not immediately respond to the applied load; the initial portion of the curve is horizontal, and a bulge is thus introduced in the curve. A certain amount of applied load is necessary in order to overcome the friction before the yarn commences to stretch. The trace is also irregular in places, showing small horizontal steps due to sticking.

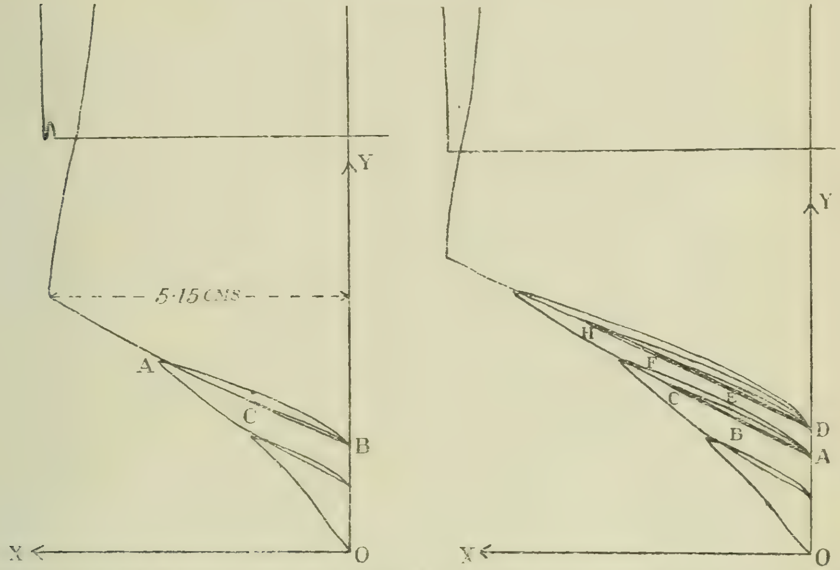
In No. 4, the effects of friction on the slide are shown by the bulge at A in the initial stage, and by the small curved or flat portions at B, C, D, and also at E. In this diagram, it will be seen that, when all the load was removed at B, &c., the drum had not quite returned to its original position. This is due, when it occurs, entirely to friction between the drum and the lower bearing. It is necessary, in order to overcome this, to use a fairly thick lubricating oil on this bearing, whilst the slides should be kept perfectly clean and lightly lubricated with a thin oil.

These diagrams were obtained from flax yarns with a constant rate of loading of 17·6 ozs. per minute and an average rate of unloading of 70·4 ozs. per minute. Some tests were made with the average rate of unloading equal to the rate of loading to determine whether this affected the diagram of type 2; no observable difference was obtained, so the quicker rate of unloading was adhered to in order to expedite the test.

Having established the changes introduced in the diagrams by exaggerating possible faults in the machine action, it is evident that these machine effects are almost entirely absent in diagrams of types Nos. 1 and 2, so we may infer that they show characteristics only due to the specimen of yarn under test.

Diagram 3.

No. 1. No. 2.

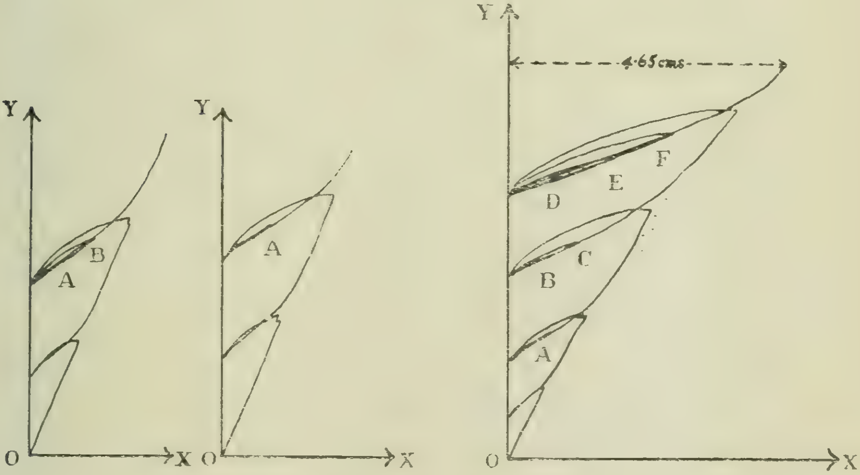


[Owing to the original diagram having to be lined in for the purpose of reproduction, some of the points mentioned in the text may not be so obvious from the reproductions as they were from the originals.]

Diagram 4.

Grey. Bleached.

No. 1. No. 2. No. 3



Stretch not magnified.

The curve shown as type No. 1, Diagram 2, indicates that as the load is constantly increased, the yarn stretches regularly, but not at a constant rate; at low applied loads the yarn stretches rapidly, but the rate of stretching gradually becomes less and less as the load increases. The rupture of a yarn consists partly of rupture of the individual fibres and partly of a drawing asunder of these fibres; the diagrams show that with flax this occurs suddenly, and there is no marked acceleration of drawing of the fibres over a certain range just before break, because this would be shown by an upward bend in the curve.

The curve shown as type No. 2, Diagram 2, is of considerably more value than type No. 1, as it analyses the stretch in the yarn at various points. For ease of description the original stretch-load curve OA will be called the "Loading Curve," ABC the "Unloading Curve from A," and CDE the "Reloading Curve from C," and so on.

The yarn was stretched to A and when unloaded it returned to C along the curved path ABC, showing that under the applied load OA_1 a permanent stretch $= \frac{1}{4}$ OC has been introduced. As soon as the load was reduced to zero, the clip below the vessel was screwed up and reloading commenced, when the yarn stretched following the curve CDEF, and on again unloading it is found that the permanent stretch is now increased to $\frac{1}{4}$ OH, and so on.

III.—DEDUCTIONS FROM THE DIAGRAM.

(*a*) *The perfectly elastic behaviour of yarns.*—It is found that the Reloading Curve can be represented almost exactly as a straight line, except for very small waves or irregularities. Many diagrams of this type have been obtained for flax yarns of different counts, material, and treatment, and this is found invariably to be the case. Under the experimental conditions used the reloading curve never returns to its original point of unloading, but attains the same stretch again under a slightly smaller applied load. When the original total stretch is attained, the rate of stretching continuously accelerates until the original curve is reached and followed.

Thus when the yarn has been stretched, on reloading it stretches regularly so that the elongation is proportional to the applied load. This suggests that the yarn has been rendered perfectly elastic, and this in fact is found to be the case as shown by the following experiment illustrated by Diagram 3. In No. 1 the yarn was stretched to A and unloaded and then reloaded. At C the application of load was stopped and again removed when the yarn returned exactly to its original length at B, and now on reloading a second time the original Reloading Curve from A is followed exactly. In No. 2 the same thing is shown in more detail; on the Reloading Curve ABC removals of load were carried out at B and C, which are approximately $\frac{1}{2}$ and $\frac{3}{4}$ respectively along the curve. On unloading from B and reloading, the path AB was followed exactly and then prolonged to C, but on unloading from C and again reloading, the Reloading Curve was very slightly higher than AB, just enough to make a distinct double line, showing that somewhere between B and C a very small amount of additional permanent stretch had been introduced. In the third loop, the Reloading Curve from D was stopped three times at E, F, and H approximately $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ respectively along the curve. Up to F the line is single, showing the two Reloading Curves to be coincident, but after unloading from H a small amount of additional permanent stretch is found, shown by the third Reloading Curve from D lying distinctly above DEF.

Further, it is found that any loop such as BC of No. 1 may be followed over and over again, showing that the condition of the yarn is quite stable. In fact, the yarn having been stretched under a load of, say, X ozs. is rendered perfectly elastic at least over the range 0—$\frac{1}{2}$ X ozs. and, in common with other elastic bodies, it shows a yield point which lies between $\frac{1}{2}$—$\frac{3}{4}$ X ozs., but it is not until the original stretch is passed that the departure from simple proportionality of stretch and load becomes very marked.

The foregoing remarks apply to flax, whether green, boiled, or bleached, and hemp. With cotton, the same behaviour is observed, with one or two slight differences. Diagram 4 shows load-stretch diagrams of this kind taken on 10's lea grey and bleached American cotton yarns, without magnification of the yarn stretch, the letters indicating points at which the various reloading curves were stopped and the load again removed.

Regarding the bleached cotton No. 3, it will be seen that, when the unloading point is about one-third of the original stress before unloading, the yarn appears to go back to its original length over exactly the same path, but this portion of the curve is thickened, so possibly on diagrams taken with magnified stretch this might show up as a small loop as in the case of flax. When reloaded to one-half and unloaded, a loop is formed, but the original stretch is attained; when unloaded from two-thirds, however, additional permanent stretch is found and slight curvature of the reloading curve between one-half and two-thirds can be observed. Thus the yield point on the reloading curve seems to be at about one-half of the original stress before unloading, but the yield appears to be greater than with flax, seeing that in these cotton diagrams the stretch is not magnified.

Grey cotton has a greater rate of stretching with increase of load, but it is evident from the curves Nos. 1 and 2 that the above remarks also apply here. In these reloading curves, however, there appears a curvature immediately at the beginning where the reloading curve follows the unloading curve for a very short distance before breaking away into the straight portion. This was obtained so consistently with grey cotton that it appeared to be a definite characteristic. An essential difference between grey and bleached cotton is that the wax content of the latter is very much reduced. It was thought that this curvature at the commencement of the reloading curve might be a lubrication effect especially marked at very small applied loads due to the presence of the wax.

This theory was tested by taking the bleached cotton yarn, winding a length on to a cylinder which was then immersed in a 0·2 per cent. solution of beeswax in carbon tetrachloride. The yarn was dried and conditioned, and was estimated to contain approximately 0·7 per cent. of beeswax; Knecht (this *Jl.*, Vol. II., No. 1, 1911) states that grey American cotton contains 0·55 per cent. of waxy material resembling beeswax. On testing this waxed bleached cotton yarn, diagrams as shown in Diagram 5 were obtained. The curvature at the commencement of the reloading curve is marked, and the similarity between these curves and the curves for the grey cotton in Diagram 4 is obvious. Thus it appears that the increased rate of stretching of grey over bleached cotton, and the curvature at the beginning of the reloading curves with grey cotton due to a rapid initial stretching on reloading, are lubrication effects of the wax in grey cotton.

Since the yarn can be put into a condition in which it obeys Hooke's Law it is possible to calculate a value for the Modulus of Elasticity of the yarn from the slope of the Reloading Curves of these diagrams. Thus :

$$\text{Modus of Elasticity E} = \frac{\text{stress}}{\text{strain}}$$

$$\text{where stress} = \frac{\text{load}}{\text{area of cross section}} = \frac{X}{A}$$

$$\text{and strain} = \frac{\text{elongation}}{\text{original length of specimen}} = \frac{Y}{L}$$

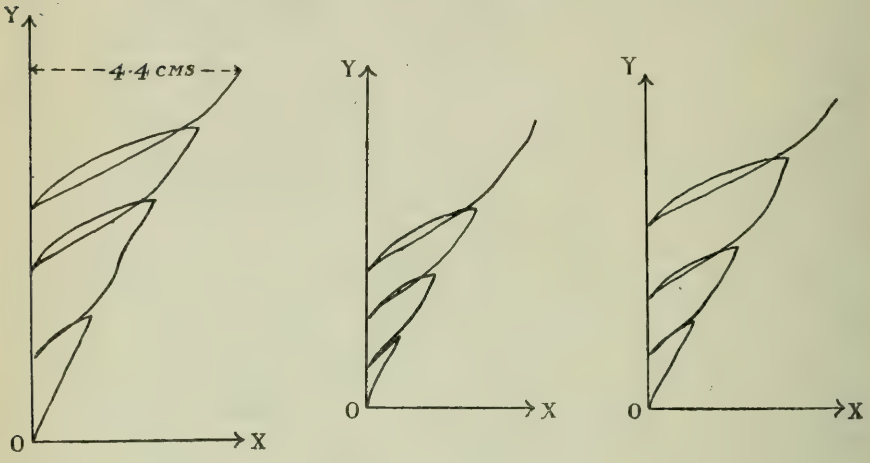
$$\therefore E = \frac{X\ L}{A\ Y} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \text{(i)}$$

X, Y and L can be obtained from a diagram of type No. 2, Diagram 2. As regards A, since it is the yarn as a whole which exhibits the elastic behaviour, A should be taken as the average area of cross section of the yarn.

To be very accurate, measurements of the diameter should be made on each sample before testing, but in practice it is more convenient and probably sufficiently accurate to work as follows :—From the data obtained from the diagram the product EA can be evaluated; the average area of cross section can be readily obtained for the sample by the apparent density method described by the author (this *Jl.*, Vol. XII., No. 12, December, 1921), and hence the mean value for the Modulus of Elasticity.

DIAGRAM 5.

10's Single American Cotton. Bleached + 0.7% Beeswax.



Stretch not magnified.

With all the materials examined, it is found that as the stress on the yarn before unloading increases, the value of the Modulus increases and approximately according to a linear relationship, so that the yarn becomes less and less elastic as the breaking point is approached.

Consideration of this diagram therefore shows that at any point the total stretch of the yarn consists of two kinds—one a permanent stretch and the other an elastic stretch which is recovered on removing the applied load. The permanent stretch may probably be attributed almost entirely to drawing or slipping of the fibres past one another, and to some small extent to straightening and tightening up of the fibres on themselves. The elastic stretch would appear to be due to elastic stretching of the fibres themselves.

(*b*) *Ratio of permanent to total stretch.*—Again it is found that for flax, at any point on the diagram, the ratio of the permanent stretch to the total stretch in the yarn may be taken as a constant; in some samples it may rise a few per cent., in others fall, and in still others fall and rise again. These variations never amount to more than about 3 per cent., and on the whole it appears that this ratio may be taken as a constant.

If Yt = the total stretch
and Yp = the permanent stretch
$Yt - Yp$ = Ye the elastic stretch, neglecting the very small change introduced by the yield point on the Reloading Curve mentioned above.

we have $\frac{Yt}{Yp} = K$

$$\therefore \frac{Yt - Yp}{Yt} = \frac{K - I}{K}$$

or $Ye = \frac{K - I}{K} Yt.$

Individual samples of flax yarns show a good deal of variation in the value of K, 25's—50's lea green yarns tested giving extremes of 1·4—2·0, with a mean of approximately 1·7. Taking this value for illustration, in these yarns 41 per cent. of the total stretch was elastic stretch.

This approximate constancy of the ratio of total to permanent stretch has been found to hold for flax yarns whether green, boiled, or bleached, and also for hemp, but both with the grey and bleached cotton tested, the ratio of total to permanent stretch was found to decrease as the breaking point was approached. The following Table I. shows some mean values of this ratio which illustrate the behaviour of various samples tested :—

TABLE I.—VALUES OF Yt/Yp.

Load applied before unloading.	Cotton 10^s American		Flax 30^s lea.			Hemp.
ozs.	Grey.	Bleached.	Green.	Boiled.	Bleached.	25^s lea.
2	1·6	1·81	1·72	—	1·53	—
6	1·49	1·64	1·69	1·54	1·47	1·62
10	1·36	1·50	1·69	1·53	1·48	1·59
14	—	1·42	1·70	1·55	1·50	1·59
18	—	1·38	1·72	1·56	1·50	1·60
22	—	1·34	—	1·58	—	1·58
26	—	—	—	—	—	1·58
Average			1·7	1·55	1·5	1·59
$\frac{Ye}{Yt}$ %	37·5 to 26·5	44·7 to 25·4	41	35·5	33·3	37

It has been found that under the same conditions, bleached and boiled flax yarns have a greater rate of change of elongation with load than green flax, which must be due to a greater ease of drawing or slipping of the fibres due to the removal of pectins and wax during the chemical treatment. Also, the above table shows that they have a smaller percentage of elastic stretch than green yarn. Assuming as already stated that this elastic behaviour of the yarn is mainly due to the elastic behaviour of the fibre, the elongation of the fibres in treated flax yarns during the stressing of the yarn is less owing to the greater ease of slipping of the fibres.

Applying the same argument to the cotton, the reduction in the percentage of elastic stretch would mean greater ease of drawing; if this is the case it may possibly be due to the short length of the fibre, the hold on the fibres by the twist in the yarn becoming less and less efficient due to the progressive slipping of the fibres.

IV.—CONCLUSION.

A testing machine is described which was designed for the carrying out of accurate work on the elasticity of yarns. An account is given of various features of load-stretch diagrams given by flax, hemp, and cotton taken under a slow, constant rate of loading.

In some respects it is shown that these materials behave similarly in character, although not in degree, and some differences in behaviour are pointed out. It is evident that the load-stretch diagrams obtained from yarns are greatly influenced by the character of the fibre of which the yarns are composed. Other influences, such as length of test piece and rate of loading, remain still to be investigated.

These loading and unloading diagrams are believed to be of immense importance in any research work involving yarns, recording as they do the exact history of the behaviour of the sample from beginning to end of the test. This account has been mainly qualitative, and it is hoped in a later communication to give the results of quantitative investigation of such diagrams.

In conclusion, I have to express my thanks to the directors of the York Street Flax Spinning Co., Ltd., Belfast, for permission to publish these results.

(Received 21st December, 1921.)

THE REGULARITY OF SINGLE YARNS AND ITS RELATION TO TENSILE STRENGTH AND TWIST.

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The regularity or evenness of yarns is a property of fundamental importance. Yarns may possess visual and also mechanical irregularities. The commonest test of regularity consists in winding the yarn on a dull black surface when the variations in thickness are revealed. The untrustworthiness of this test, particularly for yarns of high count, is clearly brought out if the yarn, which to the eye appears uniform, is dyed different colours and doubled, when the doubling twist is seen to have a highly irregular distribution. Another method of testing regularity is that of weighing a known length of yarn measured on the wrap reel, whereby only the average variation over 120 to 840 yard lengths is determined. This method affords no information regarding (*a*) local variations which are liable to give rise to serious defects in woven or knitted goods; (*b*) local weaknesses which entail loss of time and extra cost by breakages.

In the present research an attempt is made to examine the regularity of the *hardness of each element of a yarn*, hardness being defined as resistance to compression. The actual visual diameter of the yarn is not measured and, indeed, it is doubtful if a quantitative test of this property is practicable since even under low magnification the presence of stray fibres makes the diameter of the yarn indeterminate. Under compression, however, a means of recording mechanical regularity can be devised from which information can be deduced about the visual variations which accompany it. In this method the stray fibres are smoothed out and the interstices between them removed. The regularity determined in this way is such as would be " appreciated " by a knitting machine or a loom. For a given number of fibres in a cross section of the yarn, the resistance to lateral compression depends on the degree of hardness of twist. But in spinning it is known that where the fibre concentration is high, the twist is generally low, and, for a given load applied laterally, the compression is large so that the hardness is low. Where the fibre concentration is low, the twist is generally high, the lateral compression is small and the hardness correspondingly high. Apart from these differences, primarily due to erratic irregularities inherent in the roving, there may be hard twists forced into the yarn by a particular method of spinning. Such hard twists would not be directly dependent on fibre concentration, for they may occur even in relatively thick places in the roving. It is important to be able to detect such effects rapidly, and, if possible, by tests which are not destructive.

It is known that a high twist, providing it is not excessive, increases the tensile strength of a yarn, and therefore in addition to investigating the variations of twist on successive specimens, the variations of hardness could be determined by tensile tests on successive elements of yarn. These are tests to destruction and are moreover very laborious, since short test pieces must be used if a mere average result is to be avoided.

A continuous and automatic method of photographing the yarn is described below whereby the hardness of the yarn under compression can be tested quantitatively much more rapidly than by the usual twist or tensile machines. Moreover, the magnification of the irregularities has been raised as high as 17,800 which is something like 8 times that possible with the highest power microscope using oil-immersion (even supposing that the latter instrument were suitable for the test, which it is not, owing to the presence of stray fibres in the yarn).

The paper is divided into six parts:—

1. The photographic method of measuring regularity, controlled by (2), (3) and (4).
2. Regularity based on tensile strength tests of succesive elements of yarn.
3. Regularity based on twist tests of successive elements of yarn.
4. Relation of tensile strength to twist.
5. A discussion of the results in connection with the mechanism of the mule and ring frame.
6. Effects of the irregularities and some suggestions for circumventing them.

1.—THE PHOTOGRAPHIC METHOD OF MEASURING REGULARITY OF YARNS.

Apparatus for photographing continuously any length of yarn under high magnification.—The optical and mechanical devices are shown in Figs. 1—4. A dial indicator A (Fig. 1) graduated to read 1/10000″ was used. The vertical plunger of this instrument was fitted with a case hardened shoe S_1, in the form of a sector, the lower surface of which was accurately worked. The bottom shoe S_2 is a cylinder of case hardened steel, also accurately worked and rigidly fixed to the brass casting C. A balance weight B, fastened to a cord passing over the pulley W, served to increase the mechanical sensitiveness of the instrument by partly balancing the internal mechanism. A concave mirror M_1 is mounted on the pointer which travels over the dial of the indicator. The yarn to be examined is fed in between the shoes by the glass guide G_1 and received after passing through by the guide G_2.

As the yarn slides between the shoes, any irregularity in it is indicated by a rise or fall of the upper shoe. This causes the pointer which carries the mirror M_1 to rotate. A beam of light from a Nernst filament passes through a lens L (Fig. 2) and is reflected first by the concave mirror M_1 and, passing almost vertically upwards strikes the fixed plane mirror M_2, which is supported by the bracket E. The beam of light is reflected from M_2, towards the reader in Figs. 1 and 2, and passing through a cylindrical lens, fixed to the front of a camera, is brought to a focus on a strip of sensitive bromide paper. The camera has been removed in Fig. 2, but the slides into which it fits can be seen in the front part of the photograph. In Figs. 3 and 4, the camera is seen in position at C, and beneath it is the light-tight box X into which the bromide paper is delivered after it has been exposed. The mechanism for drawing the bromide paper through the camera and also for drawing the yarn through the shoes is described below. Behind the camera a sliding cutter (Fig. 4) is provided so that, after a suitable length of yarn has been examined, the length of the sensitized paper may be cut off and the light-tight box removed to the dark room without interfering with any other adjustment of the apparatus.

The yarn is taken off the cop Z (Fig. 3), vertically upwards, and a small tension introduced by passing it round a pair of glass guides which are hook shaped. From here the yarn passes downwards and enters the the guide G_1, whose further extremity is drawn out so as to feed the yarn at one point between the fixed and movable shoes S_1 and S_2. After passing the shoes, the yarn enters the receiving guide G_2. As shown in Fig. 1 the ends of the two guides nearer the shoes are a little lower than the upper surface of the bottom shoe, the object of this being to give no direct lift to the upper shoe in the act of drawing the yarn through. The upper shoe simply rides on the top surface of the yarn and rises or falls in accordance with the irregularities which the element of yarn in contact with the two shoes momentarily presents.

The driving mechanism for drawing the yarn through the shoes at a uniform rate and also for operating the sensitized paper is shown in Fig. 3. S is the starting switch, M a motor which drives the pulley P through reduction gearing. When the motor is started, the yarn is drawn from the cop through the shoes at a uniform rate and finally wound on the pulley P. In most of the experiments the speed of the yarn was about 1ft. per minute, but it appeared from trial experiments that the speed could be varied considerably above or below this amount without affecting the results. The shaft K (Figs. 2 and 3) is the axis of the pulley P and a crank on K engages a pin fixed to a second crank attached to the camera (Fig. 4). The latter operates a roller in the front bottom part of the camera and draws the strip of bromide paper through the camera at a rate exactly proportional to the rate at which the yarn is drawn through the shoes. The bromide paper moves vertically downwards in the front part of the camera, and, as the top shoe rises or falls, according to the variation in the hardness of the yarn passing through, the beam of light moves horizontally over the bromide paper, the result being a curve (Fig. 5) traced on the paper showing under high magnification how the hardness of the yarn varies from point to point. This trace represents the upper surface of the yarn. The actual yarn* thickness is of the order 40/10000″ and, since the lateral magnification is 2224 (see below) would be represented by a distance of 9″ at right angles to the trace as shown in Fig. 5. The bromide paper moves slowly compared with the yarn. The ratio of the diameter of the pulley P to that of the roller in the camera is 5·8/1 so that the yarn, which travels at 1 foot per minute, is moving 5·8 times as fast as the bromide paper. The photographs are thus contracted in the longitudinal direction of the paper in the ratio of 1/5·8.

The lateral magnification produced by the optical and mechanical arrangement described above can be calculated as follows:—Suppose the top shoe S_1, rises 1/10000″ owing to some irregularity in the yarn. This will cause the concave mirror M_1 to rotate through one division of the dial scale. As there are 100 divisions in the whole circumference of the dial, the angular displacement of the mirror will be 360/100 or 3·6 degrees, and the reflected beam of light will move through twice this angle, *i.e.*, through 7·2 degrees. In Fig. 6 the path of the beam of light from M_1 to M_2 and the camera is shown. The distance from M_1 to M_2 is 0·39″, that from M_2 to the bromide paper is 1·38″. The total distance from M_1 to the photographic paper is therefore 1·77″ and the lateral distance through which the beam of light moves across the photographic paper when the top shoe is displaced by 1/10000″ is $7{\cdot}2 \times 3{\cdot}14 \times 1{\cdot}77/180$ or 0·2224″. Therefore 1/10000″ is magnified by this arrangement to 0·2224″ and the lateral magnification is 0·2224/(1/10000) or 2224.

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*This particular yarn was 100^s weft, combed, Egyptian. See also Plates I., II., X.–XIII., XXIV., and XXV.

FIG 1.

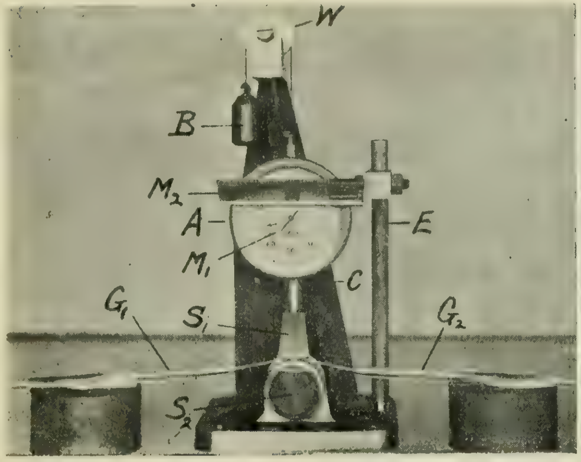


FIG 2.

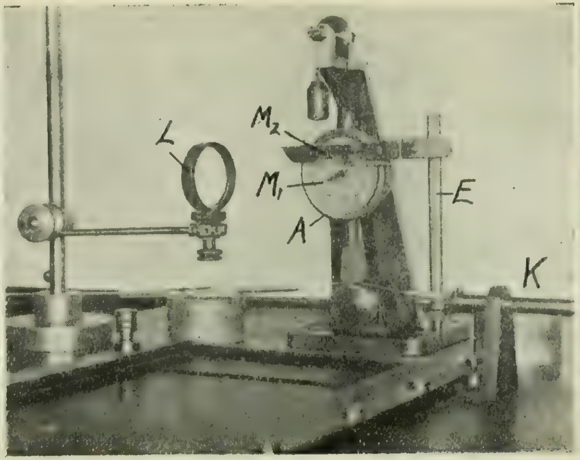


FIG. 3.

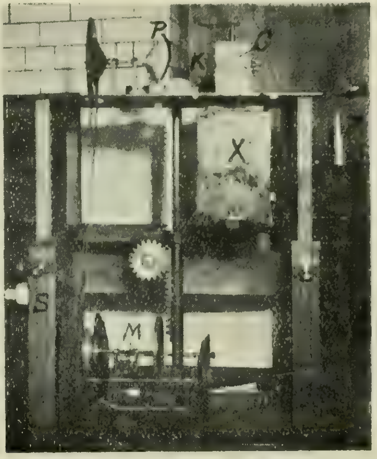


FIG. 4.

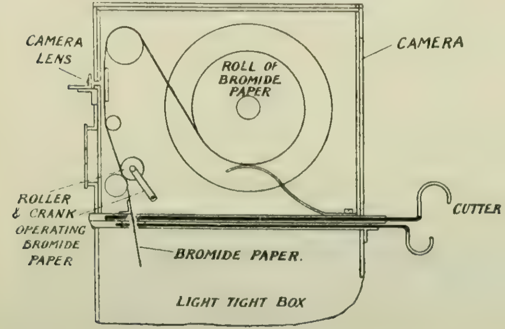
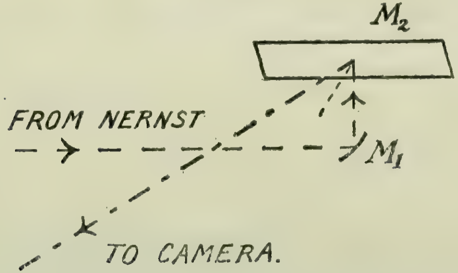


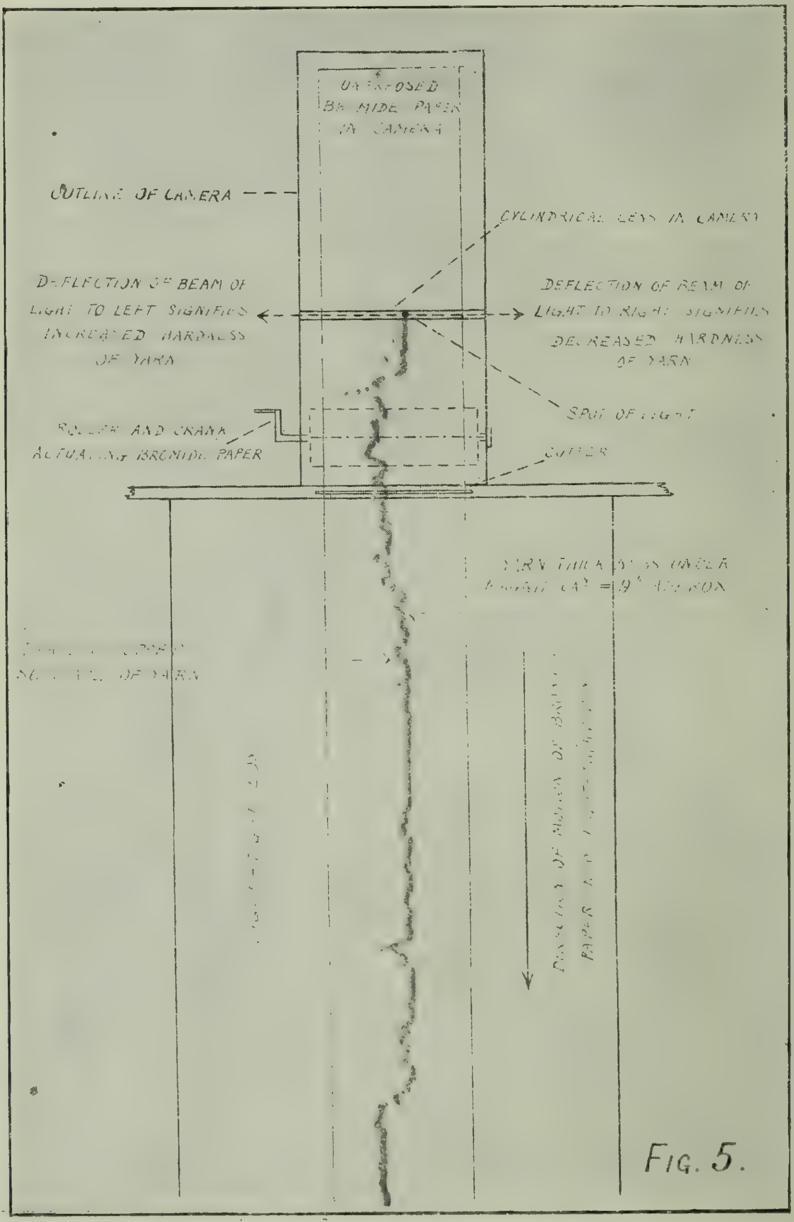
FIG. 6.



But, as previously described, the photographs are contracted longitudinally in the ratio of 1 : 5·8 and therefore the slopes of the photographic trace, corresponding to the irregularities in the hardness of the yarn, are increased 5·8 × 2224 or 12900 times.

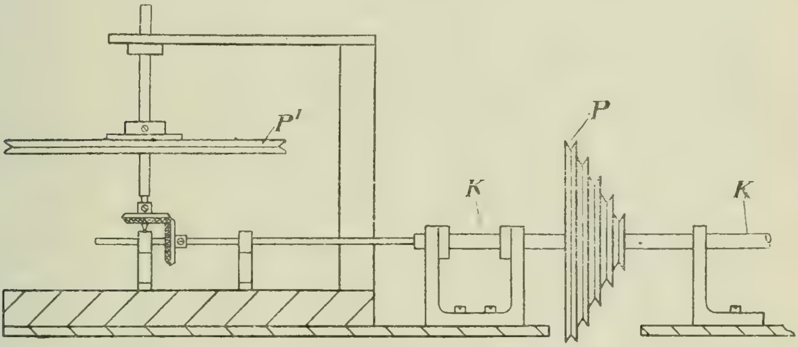
The tension required to draw the yarn through the shoes was found to be about half an ounce. This was satisfactory up to 120's counts. In some later experiments on 175's and 200's counts, considerable trouble

FIG. 5.



arose through the yarns breaking. To overcome this difficulty a modification of the method of winding was introduced which is shown in Fig. 7. The shaft K was prolonged and, by the aid of bevel gearing, the yarn was wound on the pulley P_1 instead of the pulley P. With this arrangement a right-angled turn of the yarn was avoided and, by eliminating the extra tension, due to friction, accompanying this, a reduction of the required tension from $\frac{1}{2}$ to $\frac{1}{3}$ of an ounce was made. This is well below the lowest tensile strength observed in a sample of superfine yarn spun to 200's count from Sea Island cotton. In this modified winding apparatus, the ratio of the diameter of the pulley P_1 to that of the roller in the camera is 8·0/1, so that the contraction of the photographs longitudinally will be 1/8·0 and the increase in steepness of the slopes of the photographic trace 8·0 × 2224 or 17800 times.

FIG. 7.



Sixty photographic tests have been made on various yarns of counts ranging from 32's to 200's. Most of the yarns examined were mule spun but some ring yarns have been tested. A selection of the original photographs is shown in plates I-IX. These will be discussed but briefly here, a more detailed reference being reserved in section (5) in connection with the mechanism of the mule and ring frame.

It will be seen that in all the mule spun yarns there is a definite indication of a periodicity in *hardness;* in some cases, *e.g.*, plates I and II, a fairly sharp peak occurs at regular intervals along the photographs, while in others, *e.g.*, plates III, IV and V, the peak is much more broadened, the slope being quite gradual on one side. The periods are not always quite the same, though they are nearly so. While twist is being inserted, the yarn is under tension, and, if the roving for the separate draws were slightly variable, different contractions of the stretches would be expected when the winding motion is in operation if the faller wires do not exactly take up the extension of each draw. For the photographs shown in plates I and II and in Fig. 5, the contraction factor is 1/5·8 and 1″ on the photograph measured horizontally represents 5·8″ of yarn. An examination of the photographs shows that the average distance between the peaks is 11″ and hence the points on the yarn which show these irregularities are 11 × 5·8″ or 64″ apart. This distance is equal to the draw of the mule carriage, variable within the limits 53-68″, plus the amount of roller delivery motion. For the photographs shown in plates III and IV, the contraction factor is 1/8·0 and therefore 1″ on the photographs represents 8″ of yarn. The distance between the maxima in these photographs is $7\frac{1}{2}''$—$7\frac{3}{4}''$ which represent lengths of yarn 60—62″ corresponding to the draw in spinning 175's. In plate V, for 200's counts, the distance between the peaks on the photographs is a little less, viz., about 7″, and this represents a periodic variation every 7 × 8″ or 56″ along the yarn.

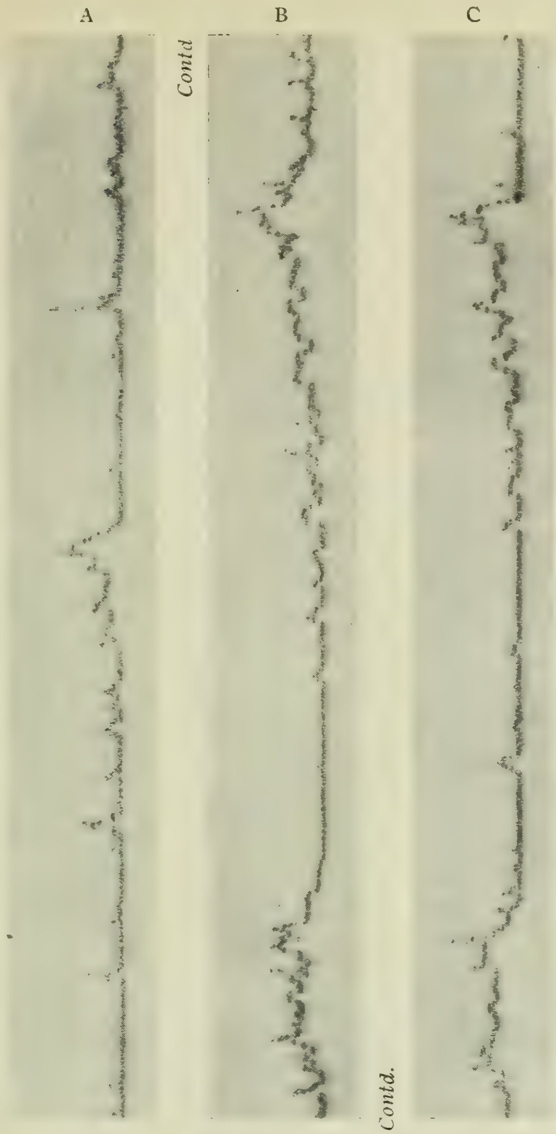
Other points of interest shown by the photographs are the gradual rise towards the peak as compared with the more abrupt drop on the other side. Again, it was noticed that the portions of the yarn corresponding to the maxima of the photographs do not coincide with those portions which are wound on a small diameter near the nose of the cop but lie always a few inches away (see page 95). As the yarn slides through the shoes, visual observation can be made on it and also on the motion of the beam of light over the camera lens. The element of yarn which gave a maximum deflection of the beam (corresponding to a peak on the photographs) always occurred a few inches before a "curly piece of yarn." The latter always came from the nose of the cop and its curliness is due to the small winding diameter at this point, viz., that of the bare spindle, which is ¼″. By introducing a slight tension into the yarn, produced by an additional glass guide, this curliness was almost removed, and although the little which remained caused the beam of light to oscillate over a small amplitude, this part of the yarn in general corresponded to a minimum deflection on the photographs. Such elements of yarn were unusually "full." In all of the hundreds of such records made, the curly part was quite distinct from the straight, and usually thinner, part which preceded it by a few inches and which showed a maximum more or less broadened on the photographs. It was also observed that the element of yarn which showed a maximum had a greater tendency to form snarls than other parts of the yarn.

Early in this work the opinion was formed that the periodicity described above arose from the intermittent action of the mule, and it seemed plausible that the real source of the effect originated from variations of twist occurring during each draw and return of the mule carriage. Superimposed upon this periodic effect the photographs show spurious irregularities due to the presence of slubs, neps and snicks. Such irregularities, however, have no constant periodicity; they are chance effects due to irregularities in length, diameter and arrangement of the original fibres, the rough treatment to which the cotton has been subjected, in ginning and in the blowing room, variations in lap weight, etc., which, even though the subsequent operations from carding to spinning were perfect in their mechanism, would still produce spurious irregularities in the finished yarn.

The periodic irregularities depend upon the mechanism of the mule. During the photographic tests, the yarn is subjected to a lateral pressure of about 2½ ozs., and is compressed considerably thereby. If the yarn has a low twist it will be softer, and, therefore, under the compression of the top shoe, it will appear thinner. If it has a high twist it will be harder and under the same compression it will appear thicker. It will be observed that the maxima and minima which have been photographed will in general correspond to the minima and maxima of the visual irregularities, and abundant evidence that this is so has been obtained. If the peaks on the photographs are produced by portions which are harder, it should follow that the number of turns per inch should be a maximum periodically, the maxima having the same interval as the peaks, viz., the length of draw of the mule carriage. Again, a variation of twist will be accompanied by a variation of tensile strength which should therefore also have a period equal to the length of draw of the mule carriage. Finally, there is the important question of the relative strengths of the maxima and minima elements shown on the photographs. Series of tensile and twist tests recorded in sections 2, 3 and 4 below have been undertaken to correlate the views outlined above.

PLATE I. (Reduced linearly to one-third.)

PHOTOGRAPHIC TEST No. 43.—Cop No. 23, 100's w., combed, Mule Spun, Egyptian, spindles rotating 8,000 r.p.m., twist 28.9 turns per inch.



PHOTOGRAPHIC TESTS Nos. 23, 24, 25, on cops Nos. 20, 21, 22, gave similar results
These cops formed with No. 23 a set of four all spun at the same time.

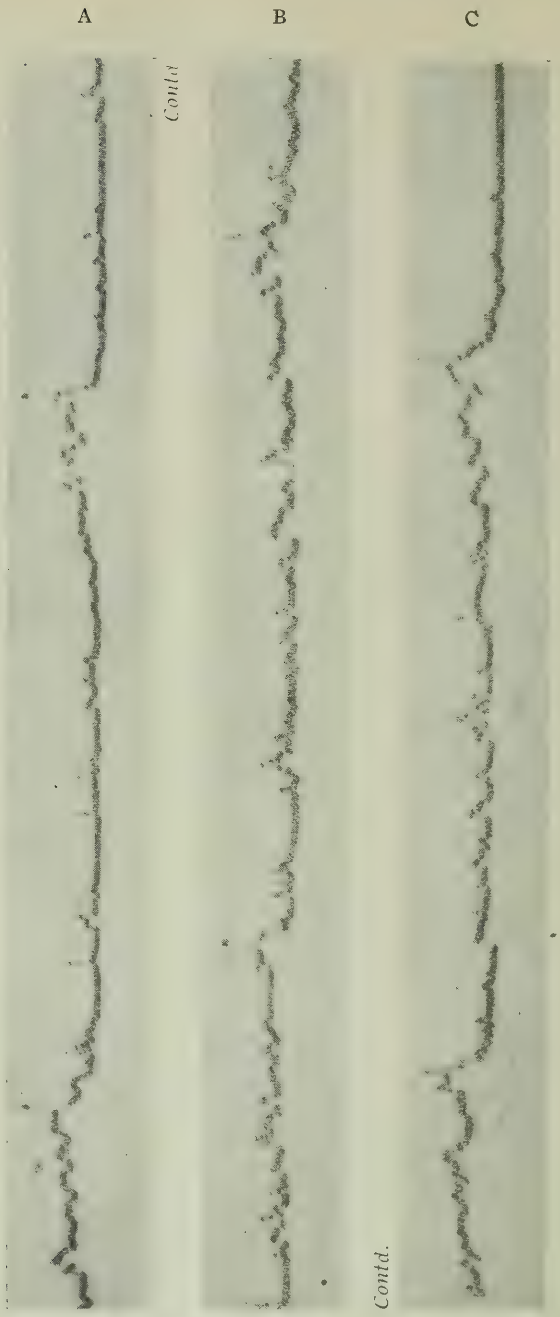
The photographs marked A and B are continuous, and if the left end of B is placed to the right of A we have three complete periods. Five additional exposures, each representing 30-40 yards of yarn from this cop have been obtained, all showed the periodic maxima, as in photograph C. The photographs A and B are of yarn which was afterwards examined inch by inch for twist, the readings being tabulated on pp. 84-85. The tensile tests recorded on p. 71 were done on yarn from the same cop.

The intervals between the maxima are equal throughout the whole series of photographs, the distance between consecutive peaks being 11″ to 11½″. In these experiments the winding pulley had a diameter of 4$\frac{3}{16}$″, that of the camera roller being $\frac{23}{32}$″. The contraction factor is therefore 4$\frac{3}{16}$: $\frac{23}{32}$ or 5.8/1 and 1″ on the photographs corresponds to 5.8″ of actual yarn. Hence the interval of 11-11½″ between the peaks corresponds to a draw of the mule carriage equal to 63.8″—66.7″.

The photographs show a more gradual rise of hardness of the yarn on the left side of the peak than on the right, but the rate of climb throughout the draw is not uniform. The magnification perpendicular to the length of the photographs is 2224, while the contraction parallel to this length is 5.8. The slopes of the curves are therefore increased 2224 × 5.8 or 12900 times.

PLATE II. (Reduced linearly to one-third.)

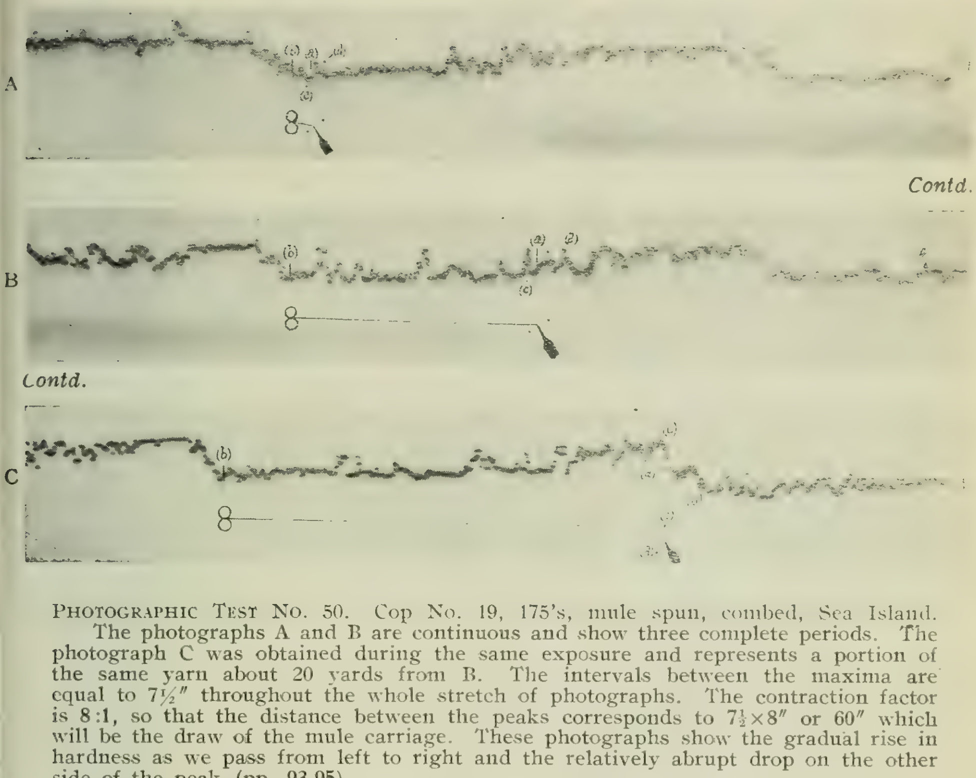
PHOTOGRAPHIC TEST No. 42. Cop 23, mule spun, 100's w., combed, 28.8 turns per in.



The details are the same as for test No. 43. These photographs are given because they show a slight variation in this cop at a considerable interval from the point where test 43 was commenced. It will be seen that the intervals are accurately preserved, though the minor irregularities between the peaks are much more pronounced than in plate I. There is also an indication of a more uniform rise of the curve on the left of the peak which was not so apparent in test 43. The abrupt fall in hardness to the right is the same as in test 43.

Magnification is the same as for plate I.

PLATE III. (Reduced linearly to one-third.)



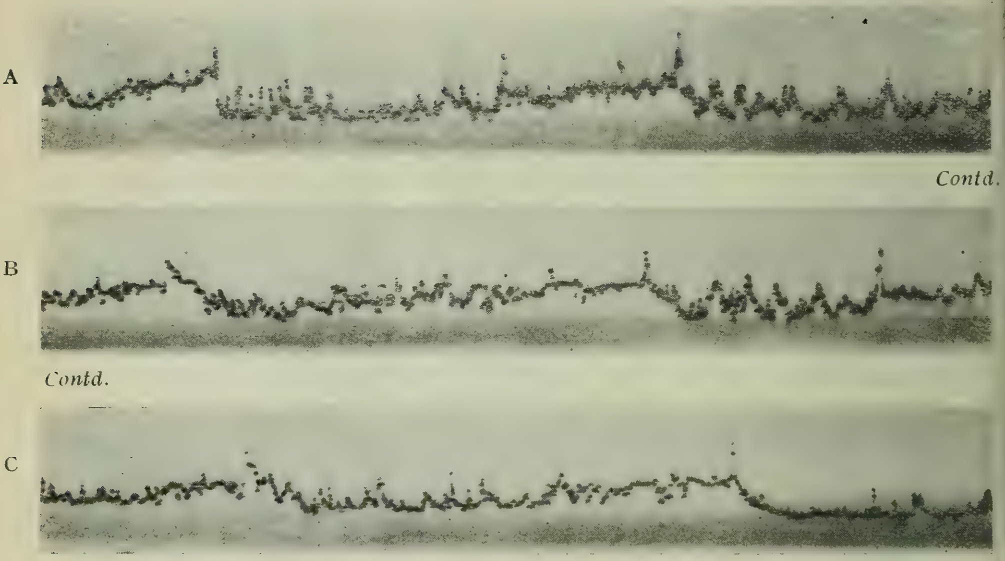
PHOTOGRAPHIC TEST NO. 50. Cop No. 19, 175's, mule spun, combed, Sea Island.

The photographs A and B are continuous and show three complete periods. The photograph C was obtained during the same exposure and represents a portion of the same yarn about 20 yards from B. The intervals between the maxima are equal to 7½″ throughout the whole stretch of photographs. The contraction factor is 8:1, so that the distance between the peaks corresponds to $7\frac{1}{2}\times 8''$ or 60″ which will be the draw of the mule carriage. These photographs show the gradual rise in hardness as we pass from left to right and the relatively abrupt drop on the other side of the peak (pp. 93-95).

Magnification, lateral 2224. Contraction, longitudinal, 8:1. The slopes are increased 2224×8 or 17,800 times.

For explanation of lettering see p. 96.

PLATE IV. (Reduced linearly to one-third.)



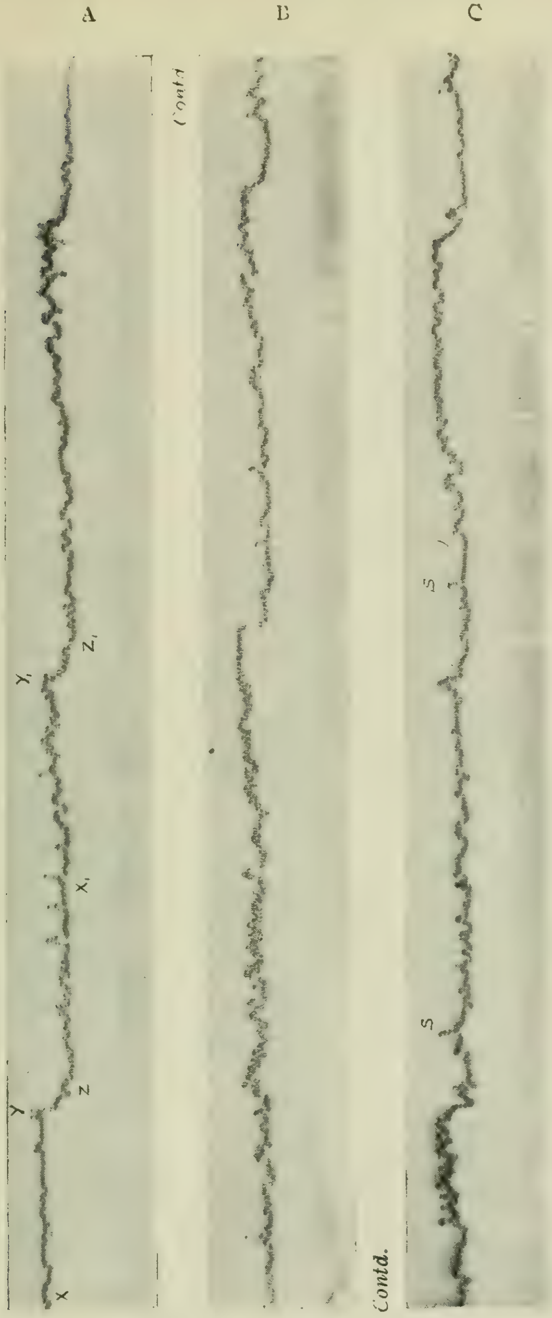
PHOTOGRAPHIC TEST NO. 51. A repetition of test 50 after partially pulling down the cop.

A continuous photograph of 30 yards of yarn showing 18 successive periods was obtained, and three of these are given in plate IV. The object was to re-test the same yarn on the tensile and twist machines. The results are shown graphically in plates XIV and XXV.

Magnification is the same for plate III.

PLATE V. (Reduced linearly to one-third.)

PHOTOGRAPHIC TEST NO. 48. Cop No. 50, 200's Sea Island, mean twist 36.4 turns per in.

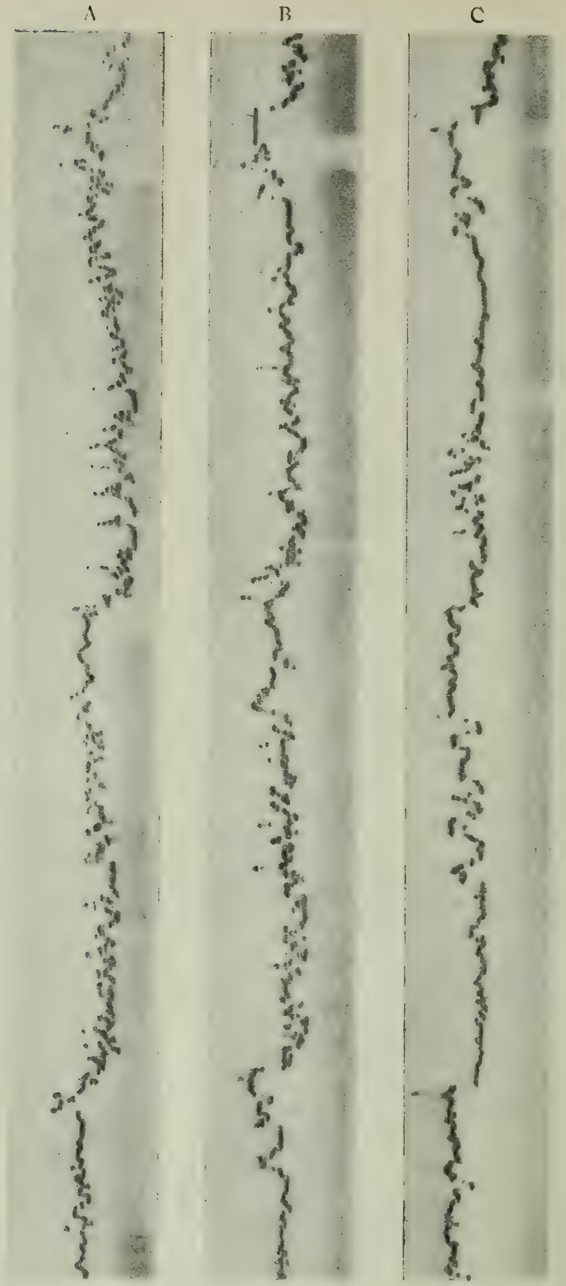


Tensile tests on yarn from the same cop show definite periods corresponding to the photograph maxima (plate XVI). Twist tests on the same piece of yarn as that photographed gave distinct periodic hard twists (plate XXVI). The variation in the distance between the peaks in plate XXVI is doubtless due to non-uniform stretch on drawing through the shoes (p. 86).

Magnification, lateral 2224. Contraction, longitudinal, 8:1. The slopes are increased 2224×8, or 17800 times.

The photographs marked A and B are continuous and show three complete periods. The complete exposure represents 40 yards of yarn including 20 successive periods with their corresponding maxima. The gradual rise of hardness on the left side of the maxima should be compared with the abrupt fall on the right side. The periods are not quite equal, the average being about 7″. The possible cause of this in high counts is discussed on pp. 93-95. The contraction factor is 8:1, therefore 1″ parallel to the length of the photograph corresponds to 8″ of actual yarn. The period 7″ thus implies a periodic variation in hardness every 8×7″ or 56″. This is the draw of the mule carriage.

PLATE VI. (Reduced linearly to one-third.)



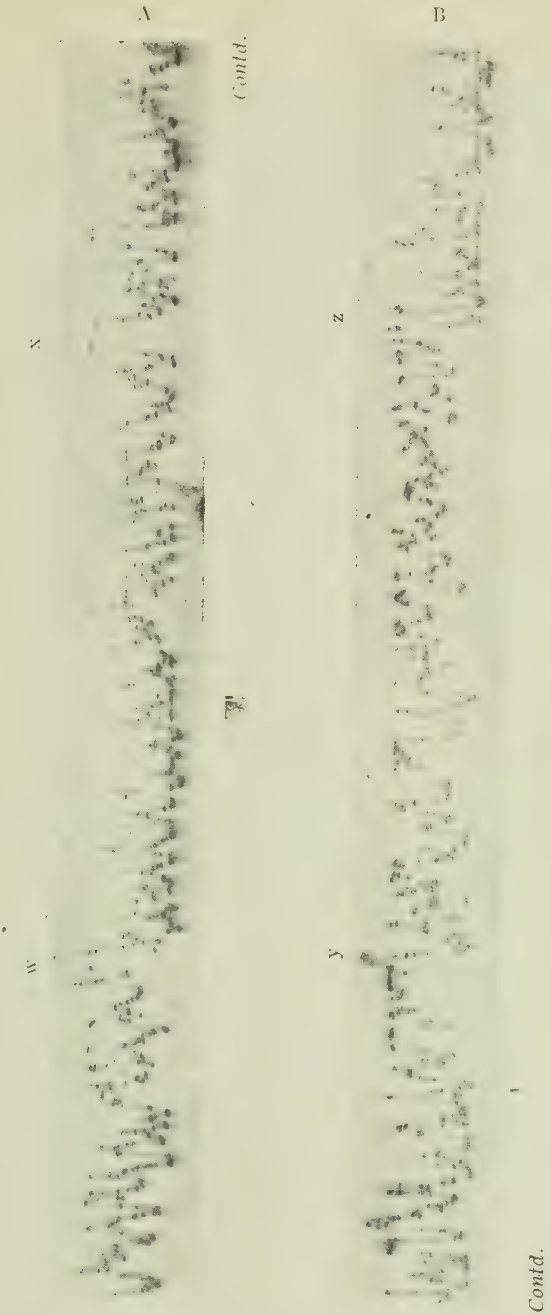
PHOTOGRAPHIC TEST NO. 54. Cop No. 24, 16 hank combed roving, mule-spun, 102's doubling weft, 28.9 turns per in., spindles revolving 8,000 r.p.m.

The photographs A, B and C show six complete periods from three parts of the same cop. The mean distance between the maxima is 7¾″, and since the contraction factor is 8, the draw of the mule carriage will be 8×7¾″ or 62″.

Magnification, lateral 2224. Contraction, longitudinal, 8:1. The slopes are increased 2224×8, or 17800 times.

PLATE VII. (Reduced linearly to one-third.)

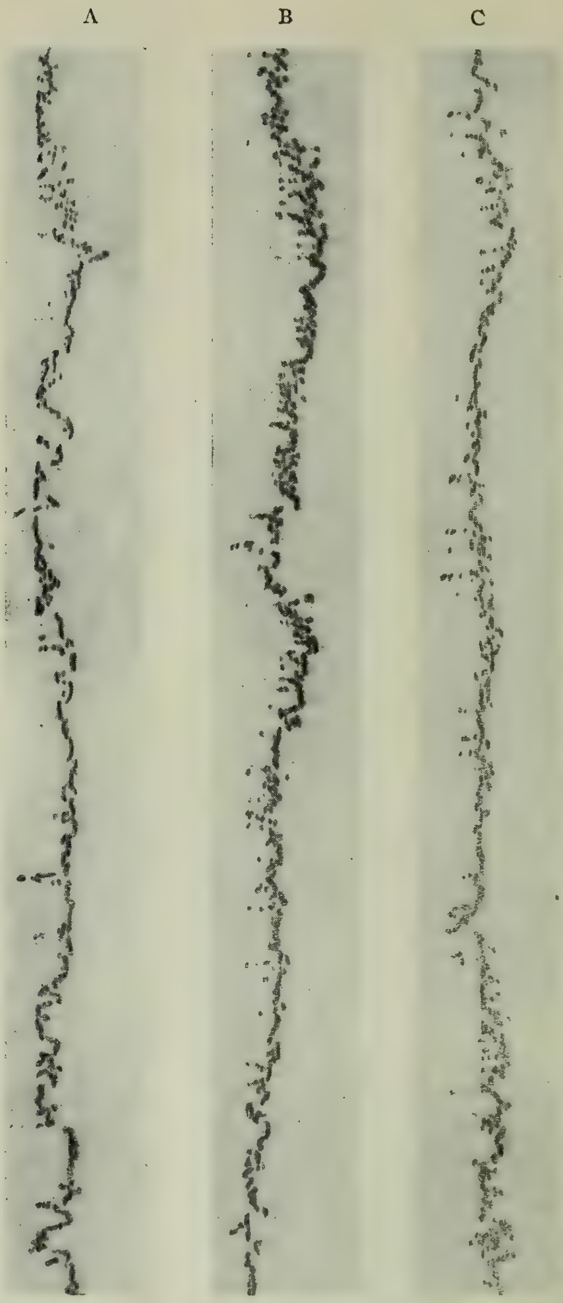
PHOTOGRAPHIC TEST NO. 46. Cop 49, Egyptian, mule-spun, 32's weft, twistway, 15 turns per in.



Magnification, lateral 2224. Contraction, longitudinal 5.8. The slopes are increased 2224×5.8 or 12,900 times.

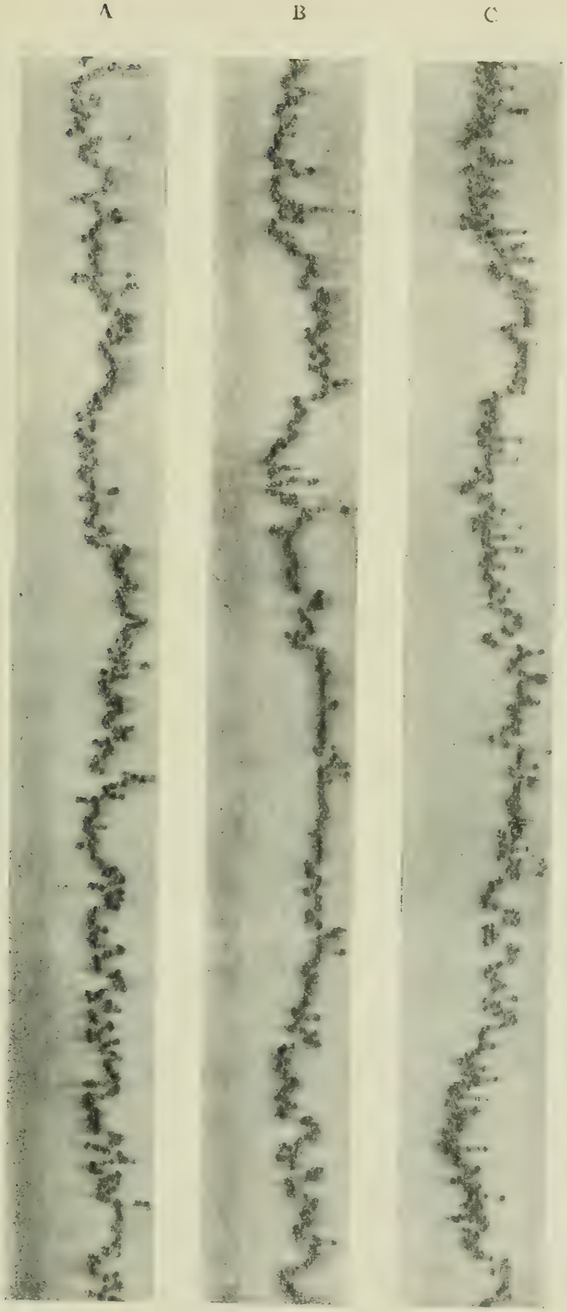
This yarn was almost too coarse for the 1/10000″ indicator, but in spite of this a definite indication of periodicity was found as shown at w-x, x-y, y-z in photographs A and B which are continuous. The distance between maxima is 10″, the contraction factor 5.8 :1, so that the length of yarn between the peaks is 58″. The actual draw of the mule was known to be 60″, the difference between these values being probably due to the tension during drawing.

PLATE VIII. (Reduced linearly to one-third.)



PHOTOGRAPHIC TESTS NOS. 44 & 45, bobbin 40, 80's super-combed ring-spun.
These photographs show no definite periodicity. The lateral magnification is 2224 and the longitudinal contraction 5.8, so that as regards irregularities these photographs are comparable with those of mule yarns, having the same contraction. The photographs in plate IX, particularly A and B, show a curious similarity.

PLATE IX. (Reduced linearly to one-third.)

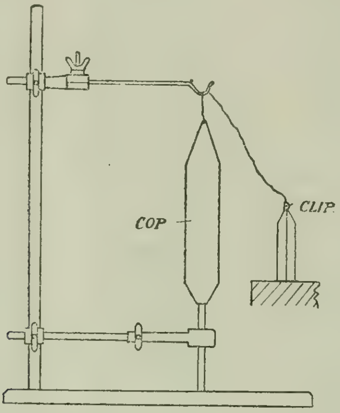


Two other photographs of mule yarns are shown in plates VI and VII. The latter is of a coarse yarn, 32's, and the 1/10000″ indicator was almost too sensitive. A less sensitive indicator reading to 1/1000″ will shortly be in use for such counts.

The absence of any definite periodicity in ring spun yarns is indicated by the photographs shown in plates VIII and IX, but further discussion of these will be reserved until the twist and tensile tests have been described.

About 2½ miles of yarn, varying in counts from 32's to 200's and representing 50 different cops, have been photographed.

FIG. 8.



2.—APPARATUS USED IN THE TENSILE TESTS.

A standard Baer single thread tester was used in all the tensile tests. The specimens were taken either directly from the cop, as shown in Fig. 8, or from the pulley, in those experiments where photographs of the yarn had first been obtained. In either case the yarn was led over a glass hook and the lengths of the specimens measured off on a rule with just sufficient tension to keep the yarn taut. In many of the early tensile tests the test pieces were 4″ long; later this was reduced to 3½″, the minimum distance between the grips being 3″, measured from centre to centre. This reduction in length was found advantageous as the number of test pieces in a given length of yarn was increased while still keeping the distance between the grips well above the longest staple length. Of course, there is always the possibility that a specially strong element of yarn may fall in the grips, and, even if it does not, it need not necessarily show itself if the specimen contains also a specially weak element, the strength of the specimen being that of its weakest part. In spite of these possibilities, some striking evidence of periodicity in mule spun yarns has been obtained, and, in the joint photographic and tensile tests made on the *same* length of yarn, it has been found that the peaks on the photographs coincide with maxima among the consecutive tensile tests.

The tensile tests were carried out in sets of 100 readings, the humidity being observed in the middle of each set. Very seldom a specimen was found to break at a point close to a grip, but almost all broke at a point near the centre, *i.e.*, midway between the grips. This is what one would expect and the few specimens which broke near a grip did so owing to weak or damaged fibres. The number of such occurrences was so small

Cop 23, Mule-spun, 100's W. Combed, Spindles Rotating 8,000 R.P.M., 28·9 Turns Per Inch.

Tensile strengths in ozs., Length of specimens 3·5″, Distance between grips 3″.

3·10	3·10	2·80	2·40	3·30	2·95	2·40	2·50	2·95	2·10
2·85	**3·50**	2·80	2·50	2·95	3·15	2·50	2·10	3·00	1·60
2·90	3·20	2·70	2·20	2·60	**3·75**	2·80	2·80	**3·40**	1·80
2·40	**3·50**	3·05	2·40	2·70	1·80	2·40	2·70	**3·50**	2·30
2·35	2·85	2·35	2·60	3·20	2·00	3·10	2·35	**3·40**	2·25
3·05	2·10	2·50	2·35	3·15	2·35	3·20	2·25	2·95	2·70
3·90	0·90	2·40	2·30	**3·50**	2·10	2·50	2·50	3·20	2·60
3·85	2·25	2·85	1·75	**3·95**	1·40	2·60	3·00	2·80	2·50
3·30	2·20	2·60	2·80	**3·80**	2·40	2·70	3·20	2·80	2·00
3·75	1·90	2·60	3·30	**3·75**	1·90	2·80	**3·30**	2·00	2·40 (*f*)
2·85	2·50	2·70	2·60	2·80(*c*)	3·10	3·20	**3·30**	3·10	2·50
1·80	2·40	3·10	2·70	2·70	2·90	3·00	1·50	3·00	2·70
3·10	2·70	2·70	2·40	2·50	2·70	2·95	2·10	2·75	2·70
2·70	2·50	3·20	**3·60**	2·95	2·50	**3·45**	2·60	3·20	2·60
3·10	2·50	3·15	3·15	2·80	2·80	**3·50**	2·80	2·80	2·80
2·70	2·35	2·85	2·00	2·90	2·95	**3·40**	3·00	3·20	3·20
2·95	2·50	**3·50**	2·80	**3·50**	**3·40**	3·20	2·95	2·80	3·00
2·50	2·80	**3·50**	3·05	2·90	3·30	2·50	3·30	**3·50**	**3·40**
2.40	3.30	**3·40**	2·80	2·60	**3·40**	2.70	3·10	**3·40**	3·20
2·60	**3·40**	2·10	3·20	2·80	**3·85**	3·00	3·00	**3·50**	2·80
3·20	**3·65**	2·60	2·70	3·05	**3·40**	3·30	3·20	**4·30**	2·50
2·60	2·70	2·70	2·90	3·00	2·80	2·95	3·10	**3·40**	2·50
2·60	**3·60**	2·50	3·20	**3·40**	2·95	2·80	2·95	**3·75**	2·90
3·30	2·50	2·35	3·05	**3·50**	2·50	2·95	2·90	3·10	2·10
3·50	2·40	2·50	2·80	3·10	2·60	2·90	2·75	2·50	2·80
2·80	2·80	3·05	3·20	3·05	2·70	**3·50**	3·30	2·25	2·60
3·60	2·60	2·70	2·85	**3·60**	2·40	**3·40**	**3·85**	3·20	3·10
3·85	2·95	2·10	2·10	3·30	2·50	2·85	3·30	3·10	3·20
1·90	3·20	2·40	3·50	2·80	2·60	2·60	**4·00**	2·80	3·00
2·80	2·80	2·35	3·05	2·30	3·00	2·80	2·00	3·05	3·05
2·50	2·10	2·80(*b*)	3·20	2·25	2·60	3·00	2·80(*e*)	3·10	1·90
2·30	2·95	2·90	**3·50**	2·70	2·90	**3·40**	2·40	3·30	2·70
2·70	2·80	2·80	**3·85**	2·80	2·70	**3·40**	2·60	3·10	2·70
2·75	2·60	3·20	2·45	2·35	2·75	2·85	3·00	3·10	3·30
2·60	2·80	3·30	2·70	2·60	2·30	**3·40**	2·50	**3·50**	3·10
2·80	3·05	**3·95**	2·50	2·80	**3·40**	2·30	**3·40**	**3·50**	3·20
2·80	2·85	3·15	2·40	2·80	**3·50**	2·40	2·70	**3·65**	**3·40**
2·25	3·00	**3·40**	2·70	2·60	**3·65**	1·90	3·00	**3·40**	2·30
2·80	**3·50**	2·10	2·00	2·60	2·40	2·30	2·95	**3·75**	3.20
2·40	2·95	2·50	3·05	3·15	**3·60**	2·50	2·70	**4·00**	2·20
2·70	**4·00**	2·70	2·60	2·95	3·20	2·40	2·30	**4·40**	2·80
2·60	2·95	2·25	2·70	3·00	2·50	1·80	3·00	**3·60**	2·60
2·90	2·70	2·50	2·60	2·25	2·50	2·80	3·00	2·05	1·60
3·20	1·90	2·10	2·80	2·50	3·10	2·70	2·85	2·40	2·70
3·75	2.40	2.25	3·10	**3·20**	2·80	2·40	**3·50**	2·50	3·00
4·00	2·85	3·05	2·25	3·00	3·10	2·50	**3·75**	2·80	2·95
3·30	3·30	2·80	3·30	**3·20**	2·75	2·50	**3·70**	2·50	3·20
2·60	2·25	2·50	3·20	3·05	2·70	3·10	2·40	2·60	2·80
2·80	3·20	2·60	**3·50**	**3·20**	3·05	3·00	2·60	2·75	2·60
3·10	3·20	2·60	3·00	2·00	2·80	2·70	2·15	2·40	3·30
3·15(*a*)	3·05	2·70	**3·75**	2·70	3·10(*d*)	3·30	2·10	2·40	2·80
3·20	2·95	3·30	2·40	2·60	2·25	2·80	2·40	2·70	**3·40**
3·20	3·20	2·50	**3·60**	2·60	2·95	**3·40**	2·80	2·60	**3·85**
2·90	3·10	**3·30**†	2·50	2·80	3·20	1·40	2·00	2·80	**3·65**
3·00	3·05	**3·30**†	2·65	2·85	3·00	2·50	3·00	3·20	**3·90**
3·40	2·80	3·15	2·80	2·95	2·70	1·70	2·40	2·95	2·00
3·40	3·30	2·25	2·70	2·60	**3·40**	2·00	2·60	2·60	2·70
2·80	**3·50**	1·80	2·70	2·50	3·30	2·30	3·30	**3·75**	2·70
3·20	3·30	1·90	2·30	3·20	2·50	2·10	2·40	3·30	2·60
3·50	**4·00**	2·50	2·50	3·05	2·10	1·90	3·00	**3·60**	2·80

Humidity Readings: (*a*) 69% (*b*) 65% (*c*) 67% (*d*) 77% (*e*) 75% (*f*) 70%

Tensiles—Means of hundreds: (*a*) 2·89 ozs. (*b*) 2.78 ozs. (*c*) 2.84 ozs.
(*d*) 2·86 ozs. (*e*) 2·78 ozs. (*f*) 2·89 ozs.
2·84 mean.

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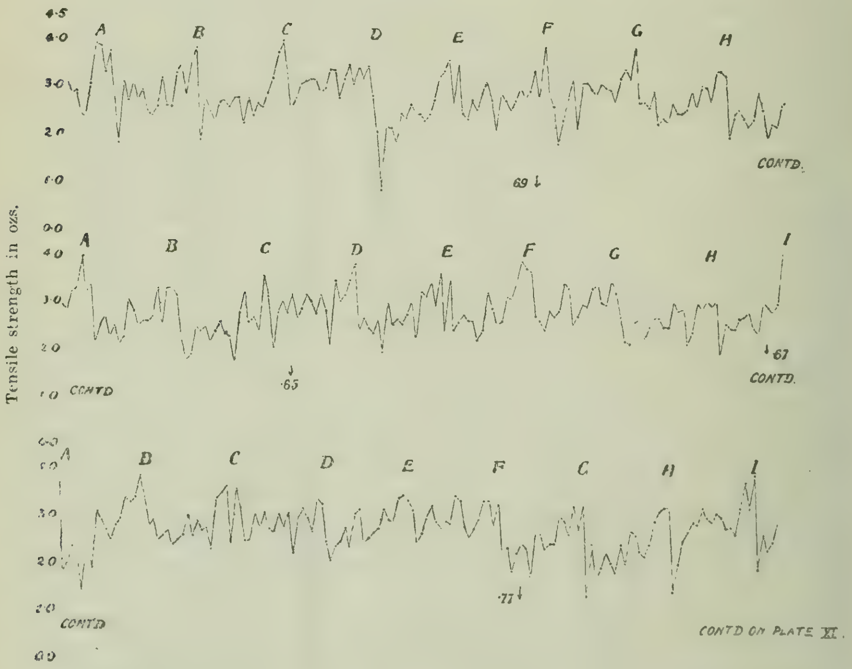
* The letters (*a*), (*b*), (*c*), etc., refer to the points where the humidity was taken, the value of the latter being given at the foot under (*a*), (*b*), (*c*), etc.

that they do not influence the conclusions to be drawn from the thousands of "normal" breaks which have been registered. All the tensile tests in a given series have been made by one observer, the aim being to secure a constant personal equation and all the observations given are without exception quoted exactly as they were recorded for each test piece.

The maxima are, of course, not of equal intensity, but there is a well-defined maximum occurring periodically throughout the tables. In some parts of the yarns where the tensile strength is unusually low, the maximum does not rise to 3·4 ozs. (marked with obelisks), but it is clearly marked against the still lower tensiles of adjacent specimens. Twelve hundred additional consecutive tests have been made similar to those recorded. The mean number of test specimens between the successive maxima is 18·3, 18·3 and 18·6 for the three groups of 600 readings. As each specimen is 3½″ long, the distance along the yarn between successive maxima is 18·4 × 3½″ or 64·4″. This is equal to the distance between successive peaks in the photographs of plates I, II and Fig. 5 (taking the contraction factor into account) and corresponds to the length of draw of the mule. These tensile strengths are plotted in plates X—XIII. The maxima are indicated by the letters A, B, C, etc. In one or two instances, where the maximum is not sharply defined, the corresponding letter is enclosed in brackets. The point referred to on p.60 regarding the

PLATE X.

Cop No. 23, Mule Spun, 100's W., combed, spindle speed 8,000 r.p.m., 28.8 turns per inch.



Horizontal distance between consecutive points=3½″ of Yarn.
Arrow indicates humidity reading.

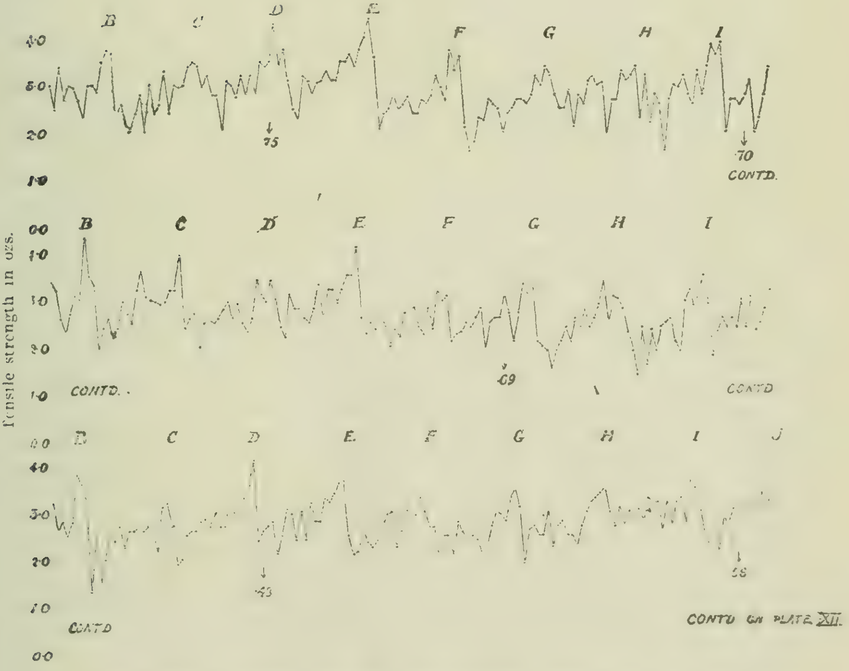
different slope of the photographic trace on the two sides of the peak is well shown in most of the periods of these tensile curves. The yarn in these tests was taken direct from the cop, as was done in the photographic tests, and the two types of curves show similarities in the gradual rise to the maxima on the left side as compared with the more abrupt fall on the right. The well defined minimum tensile strength shown in the plates almost immediately after the maximum has been passed corresponds to the curly portion of the yarn which comes from the nose of the cop. The curliness is due to the small winding diameter at this point. It was also noticed that the yarn in these elements was "fuller" and, as will be shown later, had a twist well below the normal for the particular count considered.

Similar results have been obtained with other mule spun yarns. These with the necessary data are given in plates XIV-XIX. In ring yarns no indication of a period was discernible (plates XX-XXIII).

The further discussion of the regularity of these yarns is continued on pp. 92-97.

PLATE XI.

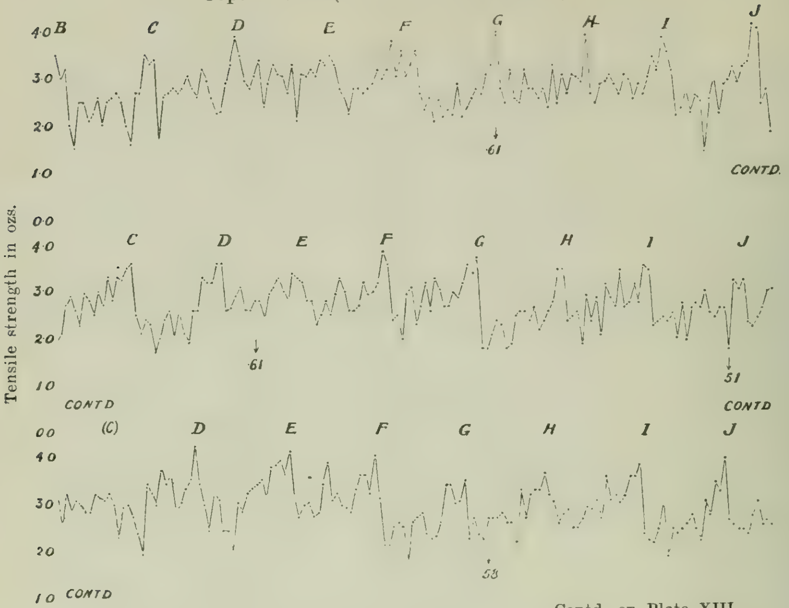
Cop No. 23 (Contd. from Plate X).



Horizontal distance between consecutive points = 3½" of Yarn.
Arrow indicates humidity reading.

PLATE XII.

Cop. No. 23 (Contd. from Plate XI).

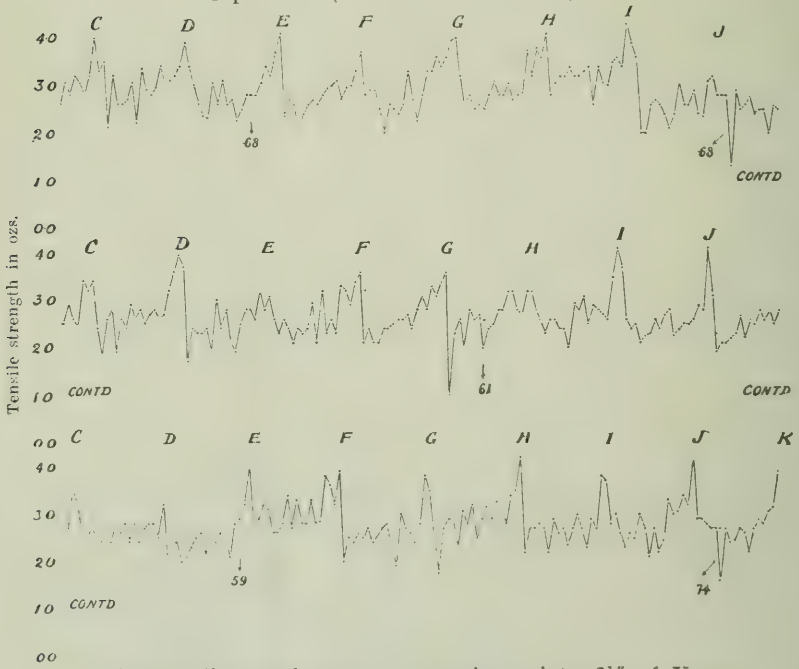


Contd. on Plate XIII.

Horizontal distance between consecutive points=3½″ of Yarn.
Arrow indicates humidity reading.

PLATE XIII.

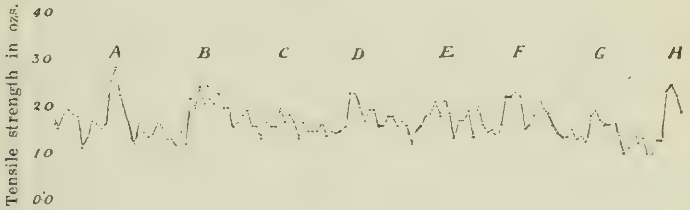
Cop No. 23 (Contd. from Plate XII).



Horizontal distance between consecutive points=3½″ of Yarn.
Arrow indicates humidity reading.

PLATE XIV.

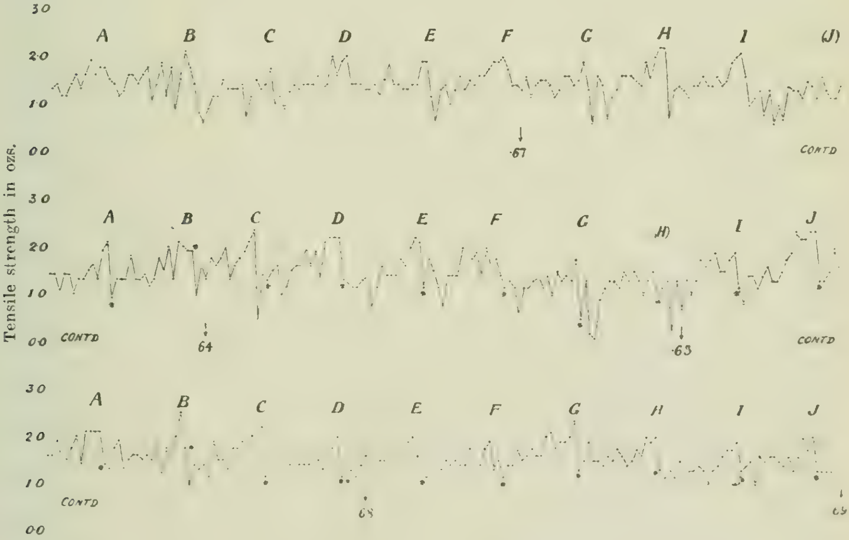
Cop No. 19 (see also Photographic Test No. 51), Mule Spun, 175's P.C., Sea Island. Humidity ·70



Horizontal distance between consecutive points = 3½″ of Yarn. Photograph of the same piece of Yarn is shown on Plate IV.

PLATE XV.

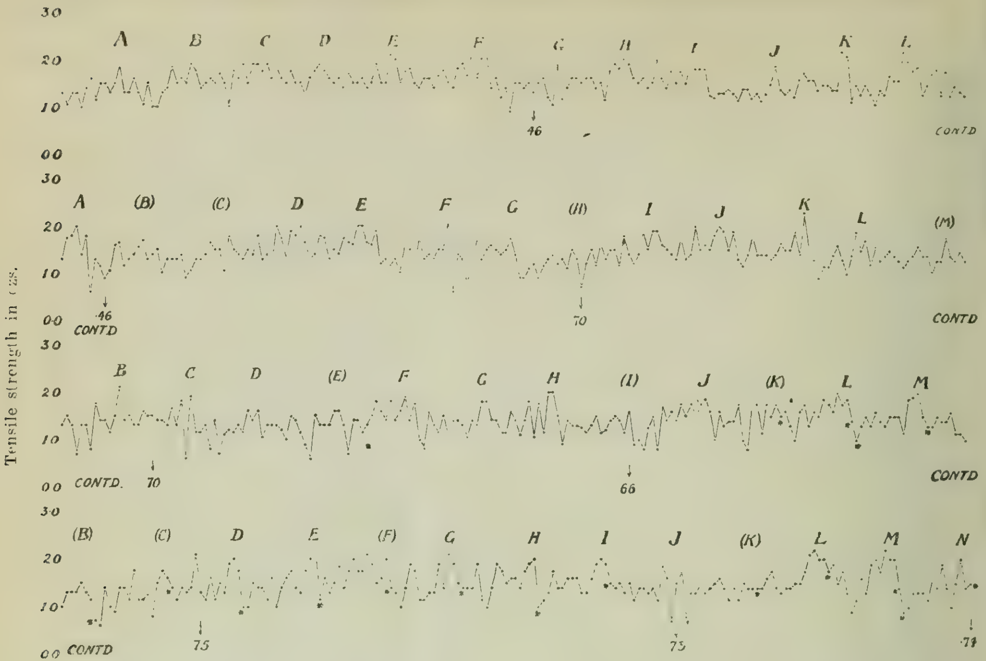
Cop No. 19, Mule Spun, 175's (P.C.), Sea Island. Arrow indicates humidity reading.



Horizontal distance between consecutive points = 3½″ of Yarn. In the last two rows, the star indicates the first test specimen (on unwinding from the cop) which has the minimum winding diameter (that of the bare spindle).

PLATE XVI.

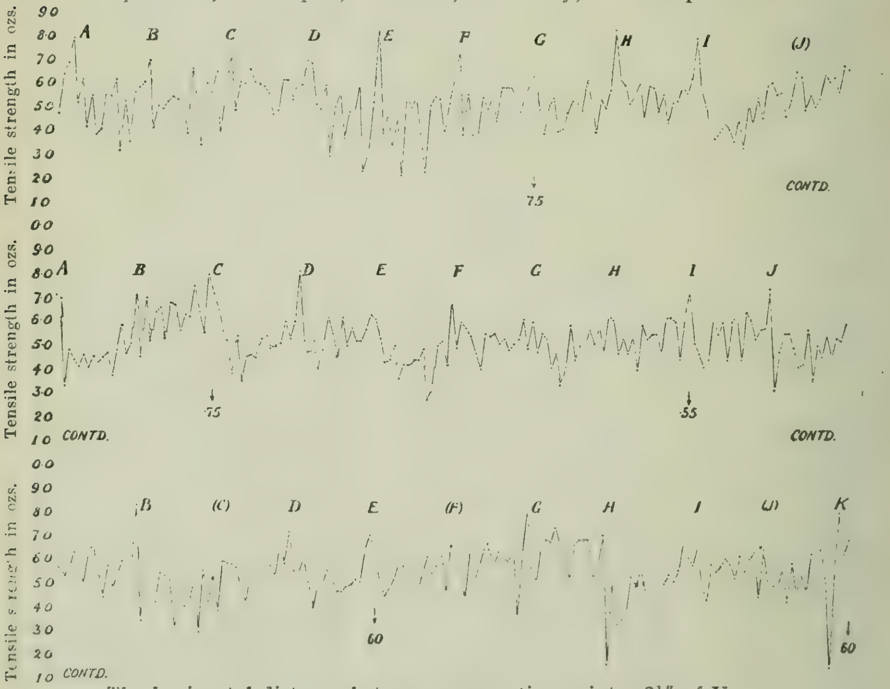
Cop No. 50, 200's Superfine, Sea Island, Mule Spun. Arrow indicates humidity reading.



Horizontal distance between consecutive points=3½″ of Yarn. In the last two rows the stars indicate the first test specimen (on unwinding from the cop) which has the minimum winding diameter.

PLATE XVII.

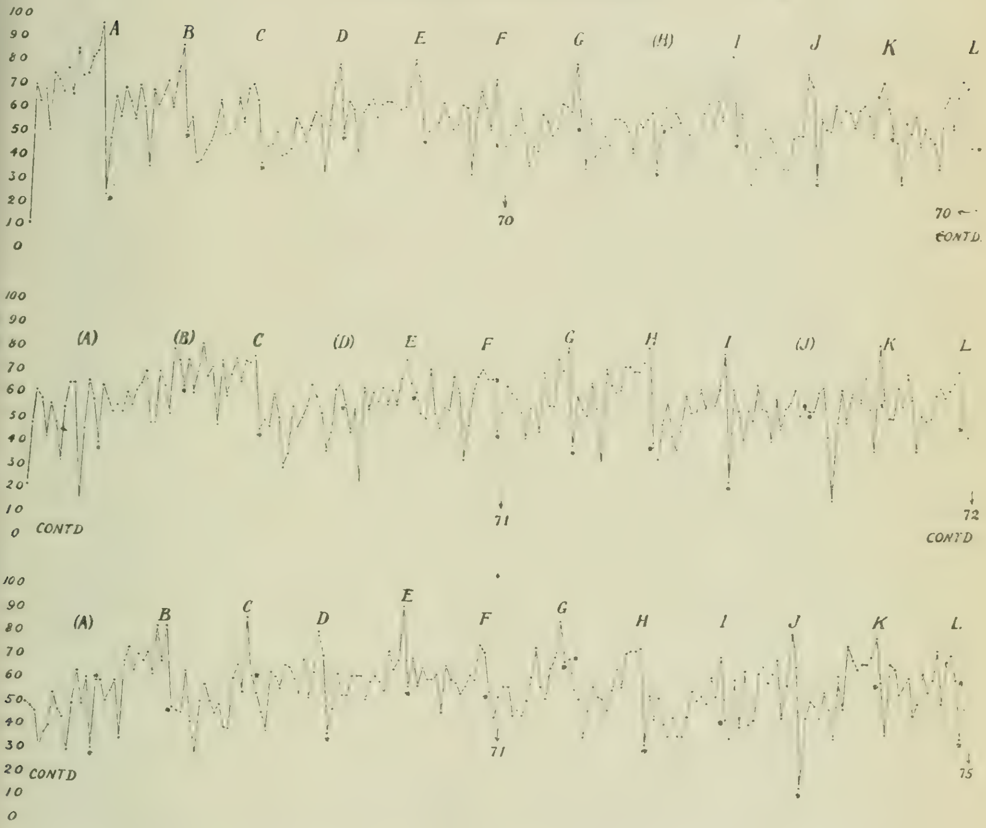
Cop No. 48, Mule Spun, 32's Weft, Twist way, 15 turns per inch.



The horizontal distance between consecutive points=3½″ of Yarn.
Arrow indicates humidity reading.

PLATE XVIII.

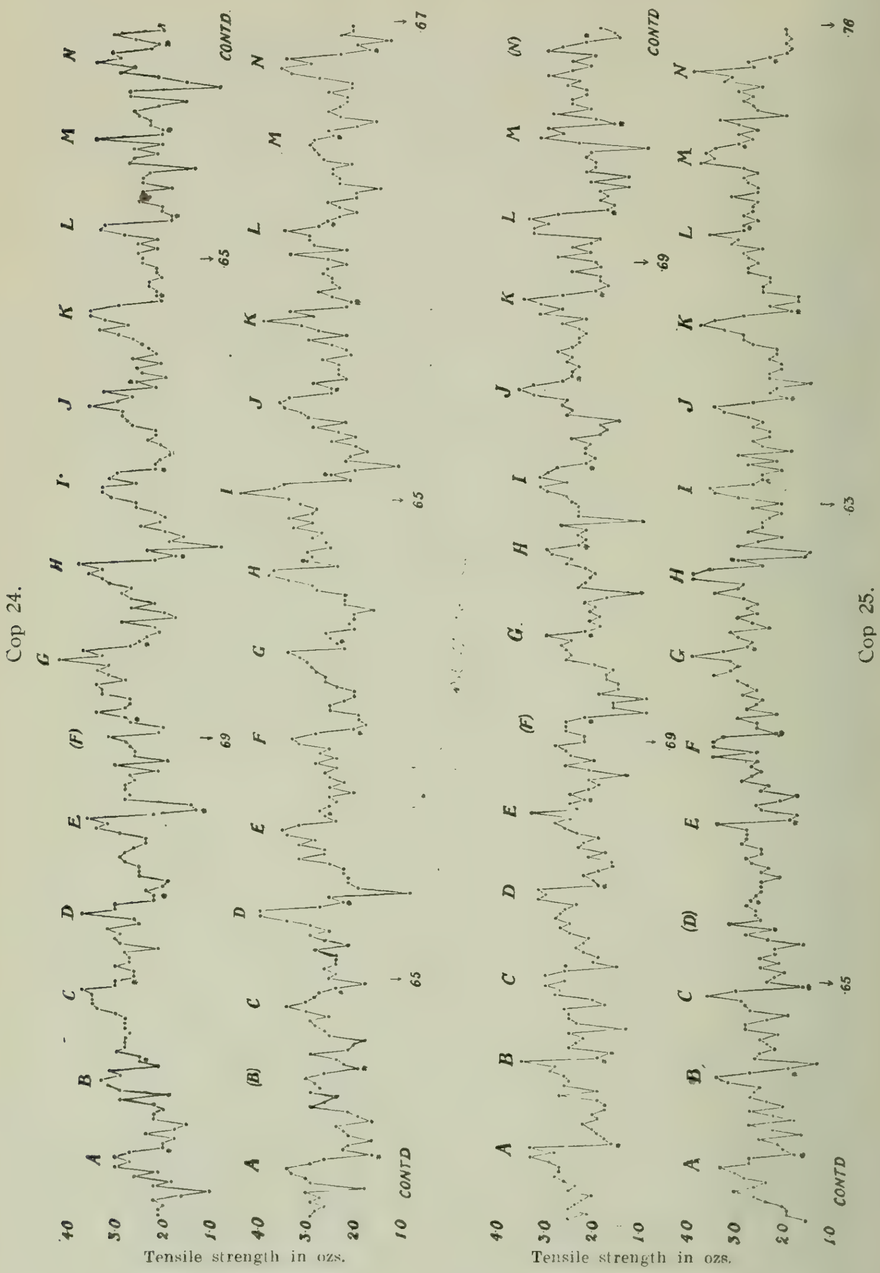
Cop No. 49, Mule Spun, 32's Weft, Twist way, 15 turns per inch.
Arrow indicates humidity reading.



Horizontal distance between two consecutive points = $3\frac{1}{2}''$ of Yarn.
The star indicates the first test specimen (on unwinding from the cop) which has the minimum winding diameter.

Plate XIX.

Cops Nos. 24 & 25, 102's, Mule Spun from 16 hank combed roving, Egyptian, 28.9 turns per inch. Bottom of cop. Arrow indicates humidity reading.

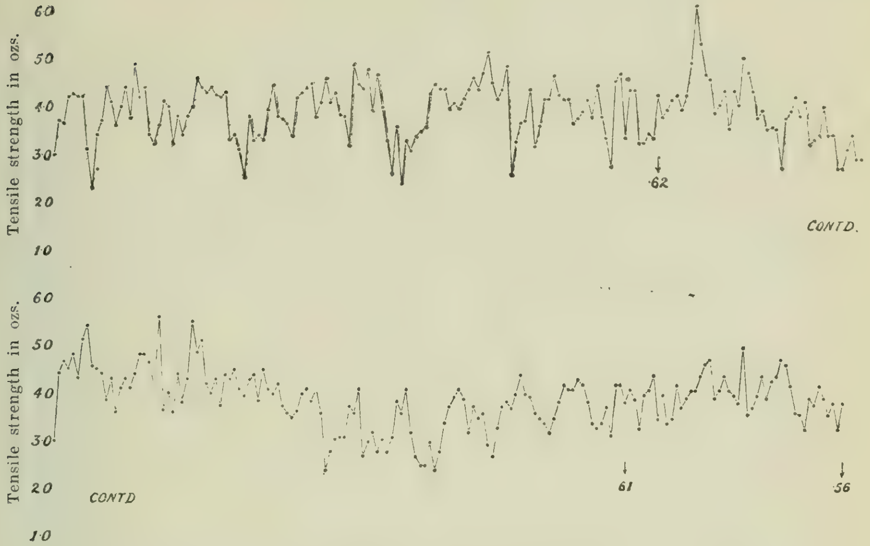


Horizontal distance between consecutive points = 3½″ of Yarn.

The star indicates the first test specimen (on unwinding from the cop) which has the minimum winding diameter (that of the bare spindle).

PLATE XX.

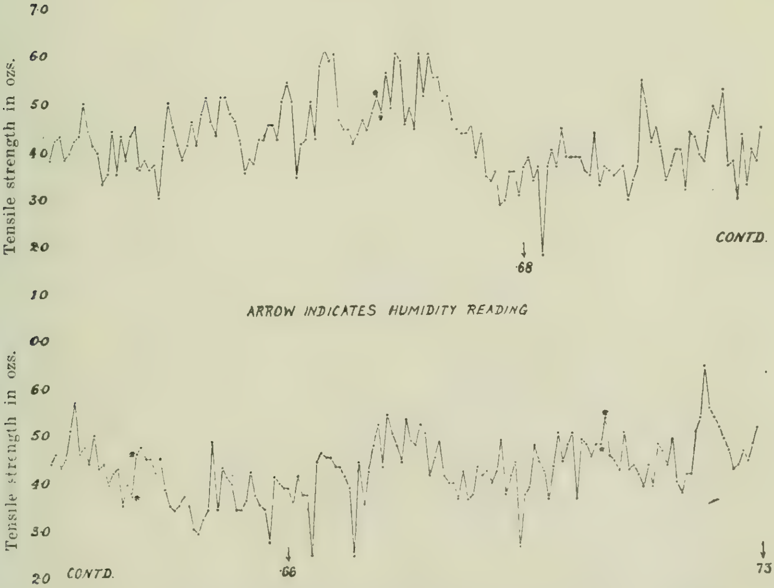
Bobbin No. 40, 80's super-combed, Twist, Ring Spun.
This stretch of Yarn was photographed in Test 44, Plate VIII.



Horizontal distance between consecutive points = 3½″ of Yarn.
Arrow indicates humidity reading.

PLATE XXI.

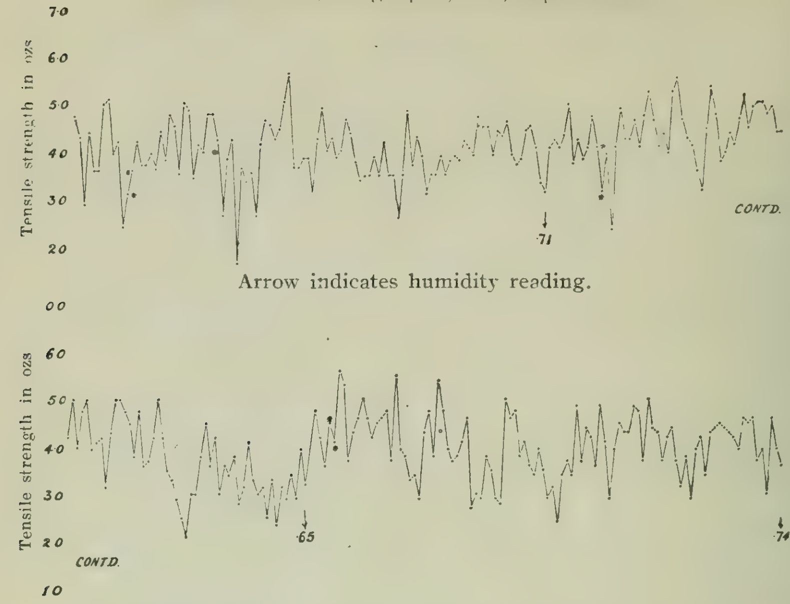
Bobbin No. 41, Ring Spun, 80's, super-combed.



Horizontal distance between two consecutive points = 3½″ of Yarn.
The star indicates the first test specimen (on unwinding from the bobbin) which has the minimum winding diameter.

Plate XXII.

Bobbin No. 42, Ring Spun, 80's, super-combed.

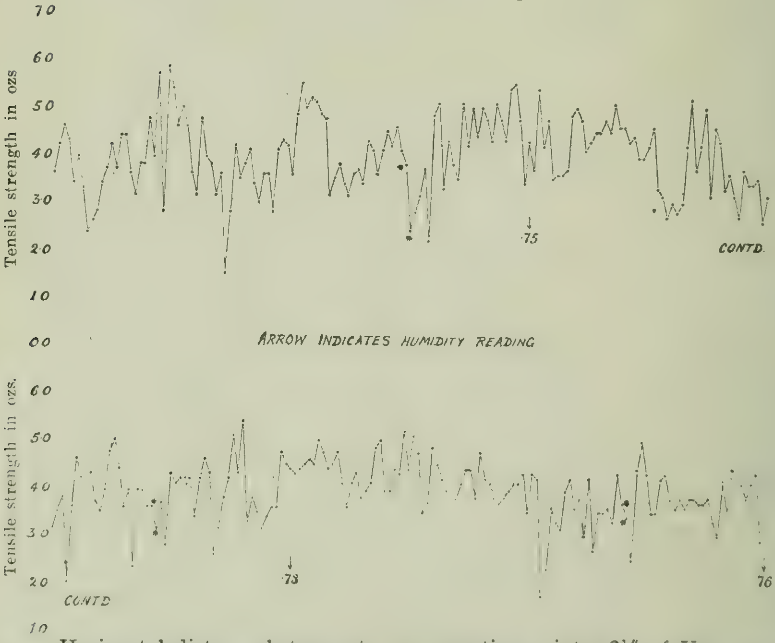


Arrow indicates humidity reading.

Horizontal distance between consecutive points = 3½″ of Yarn.
The star indicates the first test specimen (on unwinding from the bobbin) which has the minimum winding diameter.

Plate XXIII

Bobbin No. 43, Ring Spun, 80's super-combed.

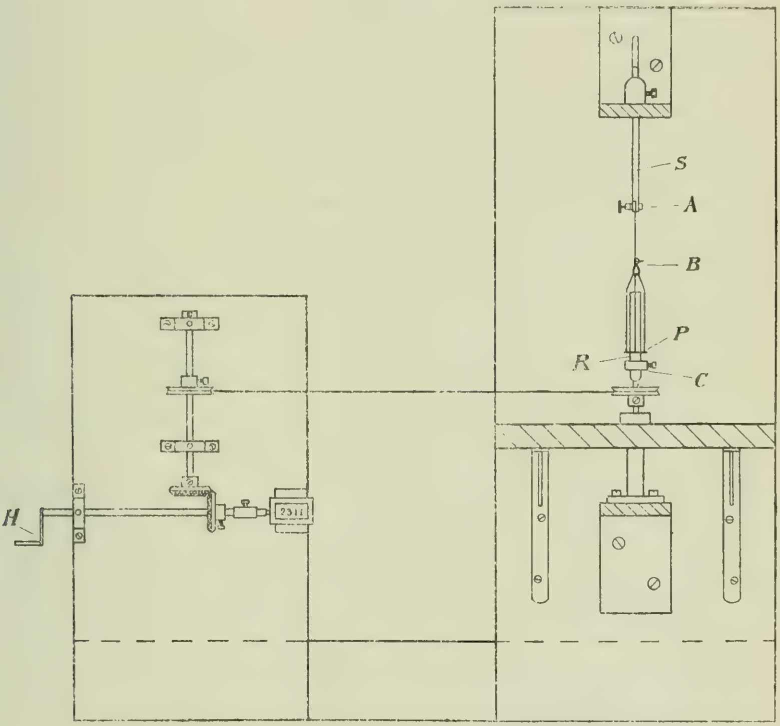


Horizontal distance between two consecutive points = 3½″ of Yarn.
The star indicates the first test specimen (on unwinding from the bobbin) which has the minimum winding diameter.

3.—APPARATUS USED IN THE TWIST TESTS.

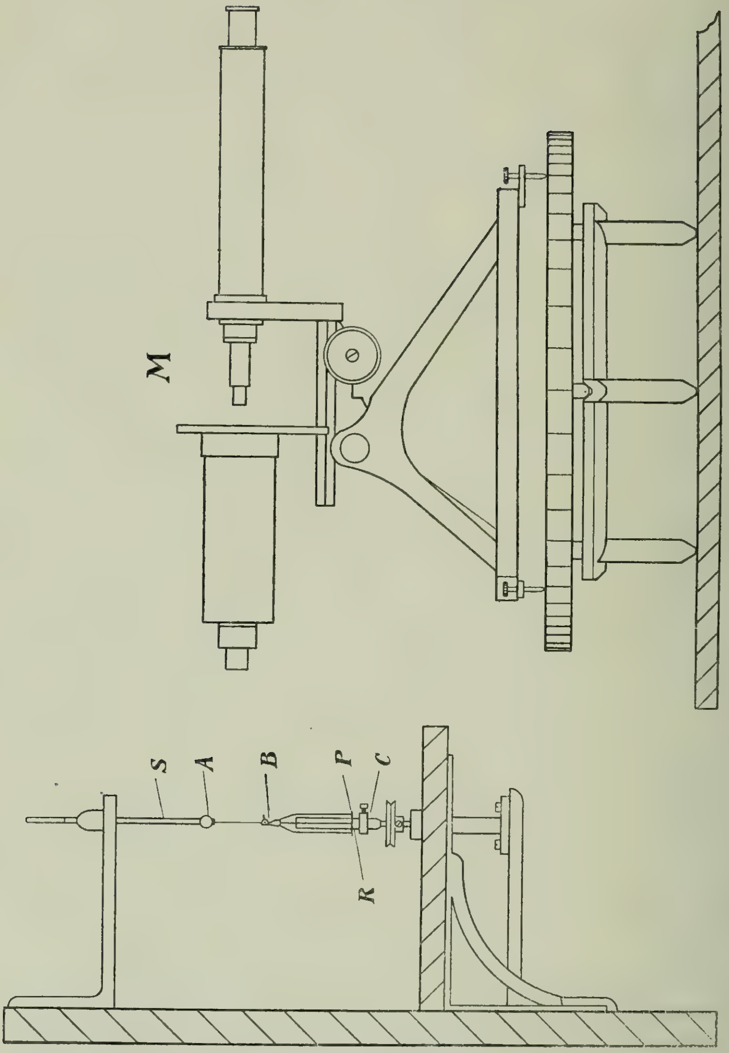
This is shown in Figs. 9a and 9b. The test specimens were each 1¼″ long and were taken off the cop, or, when the yarn had first been photographed, off the pulley, in a way similar to that described for the tensile tests. The lower grip B forms the upper extremity of a light pan P weighing 1·27 grams. The pan has a semicircular hole cut in its base through which passes a semicircular brass rod R. This rod carries a brass collar C which prevents the pan from descending below a certain point. The upper grip A is carried by the rod S the height of which may be adjusted. A stop was provided on the rod S so that for this setting of the upper grip, the nearest distance between the grips A and B is exactly 1″, the pan resting on the collar C. The free end of the yarn was held in a pair of forceps and secured in the grip B. The yarn was now passed into the upper grip A and secured, the length of yarn between A and B being 1″. On raising the rod S, the pan was lifted off the collar C thus putting a small tension of 1·27 grams weight on the specimen. The height through which the base of the pan was raised was such that the extension of the specimen due to taking out twist did not allow the base of the pan to reach the collar.

Fig. 9a.



The mechanism for taking out the twist consisted of a pair of equal sized pulleys, coupled by a well waxed belt, bevelled gearing and revolution counter arranged as shown in Figs. 9a and 9b. By turning the handle H any number of twists could be taken off the specimen, the difference between the initial and final readings of the counter giving the number of turns removed.

FIG 9b.



A tele-microscope M with $1\frac{1}{2}''$ objective in the primary and $3''$ objective in the secondary was used to view the yarn. The handle H was turned until the fibres of the yarn were parallel and as nearly vertical as possible. In most specimens the parallelism was very good, but, in some, loose fibres crossed the field at an oblique angle. These presented no real difficulty, however, as they were in general not numerous and could be readily distinguished from the remainder in the body of the yarn. The difficulty of making some measurements was caused by the presence of neps, and in some cases it was decided to divide the $1''$ specimens into two or three parts and measure the twist in each. Examples of such multiple readings are given in the following tables. In such cases it was necessary to impose a reverse twist in one part of the specimen in order to take out completely the twist in the remainder. This appears to be a legitimate way out of the difficulty, at least to a first approximation, since it was observed that in the more uniform specimens the number of rotations at different points of their length (observed by the revolution of stray fibres) was a linear function of the length of the specimen as measured from top to bottom grips. In a few cases of obviously high twist it was observed that if a reverse twist of a few turns was applied along the whole length of the specimen, the fibres became much more open and vertically parallel when this excess twist was removed. The absence of rotundity of the yarns after a number of twists had been taken out was particularly noticeable.

When one test specimen had been examined, the grip A was loosened, the yarn being held by forceps, and transferred to the bottom grip B. The yarn was now passed up towards A and secured. Consecutive specimens were examined in this way without any loss of twist occurring.

As in the tensile tests, definite confirmation of the periodicity in mule spun yarns was obtained. The peaks on the photographs correspond with high local twists, *i.e.*, a harder portion of yarn, and in some of the experiments where the same sample of yarn has first been photographed and afterwards analysed for twist, it was possible to follow not only these periodic maxima but also intermediate ones introduced into the yarn accidentally and due to knotted fibres, etc.

Certain specimens which possessed an abnormally high twist were put under the microscope and the number of fibres counted. Some of these were found to have an abnormally low number of fibres in their cross-section. Every specimen examined for twist has been mounted and a complete examination of each specimen is in progress, the results being treated statistically.

There are certain irregularities shown on the photographs which the tensile and twist tests do not show, viz., those due to snarls and knotted fibres. These can be observed as they slide through the shoes and their positions recorded on the photographs.

Cop No. 23, Mule-spun, 100's W. Combed, Spindles Rotating 8,000 R.P.M., Twist 28·8 Turns Per Inch.

Twists* in turns per inch. Length of specimen 1¼″, distance between grips 1″.

24	20	19	19, 24	20	26	32, 20	19
20	17	16	26	28, 30	23	21	21
27	21	22	20	32,19	22	23, 29	26
21	22	14	21	31, 21	24	20, 33, 23	28
22	28	**38**, 30	19	18	15	20	18, 22
28	18	27, 33, 30	28, 22	24	18	23	23
19	18	30	26	28	21	26	18
27, 18	20	21	21	31	24	24	18
23	19	20	22	22	22	21	20
18	17	21	20	18	17, 23	20	15
18	25, 20	22	35, 31	**47**, 24	21	25, 20	21
20	16	20	20	37 31	24	20, 31	18
24	21	18	33	22	18	17, 28	**39**
14	23 27, 34	15	28, 22	19	18	19	21
16	20	24	19, 14	34, 22	22	27	24
38, 34	21	16	13	34	25	27, 24	29
32	24	17	19	**40**, 36	20	18	**40**
39, 36	33, 19	19	16	23	33, 27	13	23
26	23	18	18	16	32, 35	19	18
23	24	32, **47**	17	17	22, 29	17	20
25	29	29, 23	**40**, 30	29	24	23, 36	36
30	**40**	30, **38**, **45**	31, 28	**45**, 37, 33	22	20, 26	24
26	22	25	20	**41**	35, **46**	**41**	20
24	30	34, 30	23, 18	20	30	18	18
28	26	32	21	29	35	25	17
30	28	26	24	21	20	30, **45**	31, 24
24	20	33	23	24	16	25	28, 21
20	24	24	18	20	26	**39**	27, 22
32	24	27, 35	23	24	19	29	24
33, 20	25	23	13, 24	22	28	16, 24	15
28	26	35, 26, 34	29, 34	18	36	34, 23	32
23	30, 34	20, 27	30, 23, 19	19	31	23, 29	31, 35
26	28	29	22	20, 31	22	24, 30	20
22	32	18, 29	16	27, 22	20	36	31
14	25	27	22	33	23	21, 33	25, 34
25	23	20	16, 20	25, 26	22	19	35
19	22, 14	19	25	25	27	24	19
22	22	21	32, 27, 33	34, 27	30	30	22
26	30	18	26	21	18	28	33
29	35	20	30, 25, 19	19	24, 36	18	21
22	29	18, 30	21, 30	14, 20	20	31	20
27	31	23	33, 22	28	22	30	21, 25
29	20	**39**, 31	30, 21	18	17	26	26
23	29	19, 24	15	22	18	15	36
22	30	28	22	24	21	16	22
26	31, 25	23	18	26	26	20	25
18	16	27	19	16	32	26	29
20	19	18	16, 23	31	23	29	27
20	20	22	17	21	18	23, 28	18, 26
23, 29	15	21	19	36	24	20	22, 29
30	18	20	16	18	25	22	29
22	20	23, 28	27, 20	24	17, 25	20	20

* These observations are plotted in plates XXIV. and XXV.

Where the numbers are given in two's or three's abreast, the 1″ specimen had a variable twist and was divided into two or three parts, the twists being estimated separately in each. It will be seen that particularly high twists occur at approximately a similar point in each column and these points, which are indicated in heavy type, lie roughly in a line crossing the columns in a downward sloping direction from left to right. The yarn was said to have a twist of 28·8 turns per inch. The mean of

Cop No. 23.—Twist Tests*—*continued*

24	22	20	26	18, 23	23	20	37, 29
23	20	20, 23	29	24, 29	22	26	23
26	24	23	20, 27	30	19	23	24
25	22	22	35	23	20	29	25
22	16	23	21, 30	28	18	24	23, 29
17	18, 29	27, 30	32	25	25	33	24
18	36, 26	22	25	20	24	27	19
20	30, 35	19	22, 28	22, 29	22	29, 20	23
26	24, 30	30	26	19	26	26, 23	29
19	37, 30	18	18, 27	17	32	15	23
25	18	28	29	24	24	21	28
24	20	16, 29	24	22	21	29	20
20, 26	19	29	22	23	27	17	19
27	20, 26	21	18	20	29	27	22
38	30	26	23	22	20	22	29, 21
32	21	28	21	18	28	23	14
36, 33	25	20	25	20	14	20	22
25	30, 36	24	17	19	22	22	33
20	29	22	18	23, 30	24	24	31
22, 28	16	18	17	21	26	19	22
24	20	20	22	32	24	20	34
30, 34	23	27	21	27	18	30	18
21	24	32, 23	16	24	27	24	28
20	25	33	21, 25	18	20	27	33, 25
18	21	22, 17	34, 22	25	21	15	22
17	18	17	14	22, 30	19	16	23
35	23	16	13	23	16	15	27
34, **42**, 36	20	16	28	14	27, 34	14, 22	20
29	24	19	19	23	25	21, 26	21
26	17, 28	16, 20	20	33, 25	18	20	20
28	32, 37, 32	18, 24	12	23	22	30	18, 13
25	34, **40**, 36	33, 30	20	16	17	38, 34	30, 38
22	25	34, **44**, 37	23	15	14	30, **41**	20
21	20	32, 36	19	22	20	21	21
27	34, **40**	18, 22	36	26	15	18	18
18	24	21	34	**42**, 31	25	30, 27	**40**
21	28	**47**, **40**	33, **45**	27	17, 24	31	29
23	30	26	37, 30	36	**52**, **44**	28	27
22	22	29	17	33	31, **40**	17	17
27	19, 25	23	32, 37	26	32, 21	22	16
25, 34	32	25	29	22	18	24	21
26	22	27	23	34	11, 19	25	23
24	24	32	**38**	22	20	21, 32	25
32	28	25	31	31	29	29	29, 34, 30
29	25	29	25	24	23	28	22
21	28	30	30	19	22	28	19
25	23, 32	30, 36, 34	28	20, 25	23	31	17, 25
25	30, 33	31, 20	25	20	21, 28	33, **40**	24, 30
30	24, 19	27	23	22	19	28, 17	24, 35
27	25	28	16	33, 21	21	24, 29	20, 27
23	22, 29	25	26	21	23	26	26
20	18	20	18	23, 34	21	28	20

* These observations are plotted in plates XXIV. and XXV.

the 830 tests recorded gives a value 25 turns per inch. If values 38 or over are considered, *i.e.*, those approximately 50% above the mean, then, with a few exceptions, the length of yarn included between successive high values is 52—54 specimens, each of which has a length of 1¼″.†

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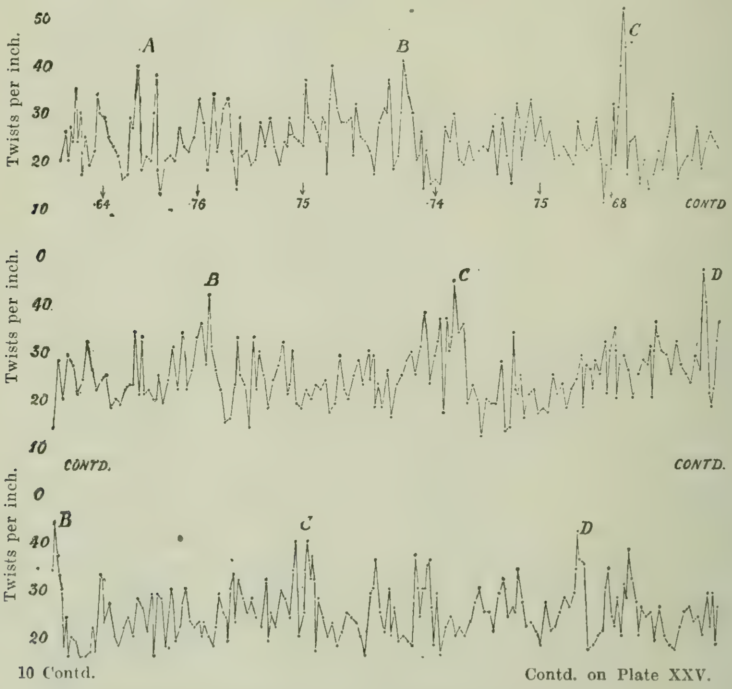
† In measuring the interval along the yarn the total length of the specimen must be taken, namely 1½″, which includes two short pieces ⅛″ long in the grips.

Therefore the distance between the maximum twists is 65—67″. It should be pointed out that this stretch of yarn had previously been photographed, and, in the process of winding it on the pulley, it would probably have become slightly extended. If so, the number of specimens between two regions of high twist would be increased and the values 65—67″ may therefore be rather high. It is, however, significant that this interval is practically the same as that found between the maxima in the tensile tests (see p. 72) the mean interval there being 64″, and this value also agrees with that determined from the peaks on the photographs (plates I and II). The extension referred to above would not be recorded on the photographs for it does not take place until the yarn has passed the shoes. Therefore, it would be expected that the periods obtained from the photographs would coincide with those found from the tensile tests, the yarn in each case being taken from the cop, while in the twist tests, made on the yarn which had been photographed, variations due to small extensions arising from drawing through the shoes would occur. There can be no doubt as to the periodicity of the twist and this is best seen in the plotted results in plates XXIV and XXV. The maximum twists are indicated by A.B.C. . . ., etc. The equality of the twist periods is shown by the approximate parallelism of the lines joining corresponding letters, *e.g.*, C,C,C, on plate XXIV and E,E,E, on plate XXV. Further, it will be noticed that there is an indication

Plate XXIV.

Cop No. 23, Mule Spun, 100's W., combed, spindle speed 8,000 r.p.m., 28.8 turns per inch. This stretch of Yarn is the same as that photographed in Test No. 43 (see Plate I).



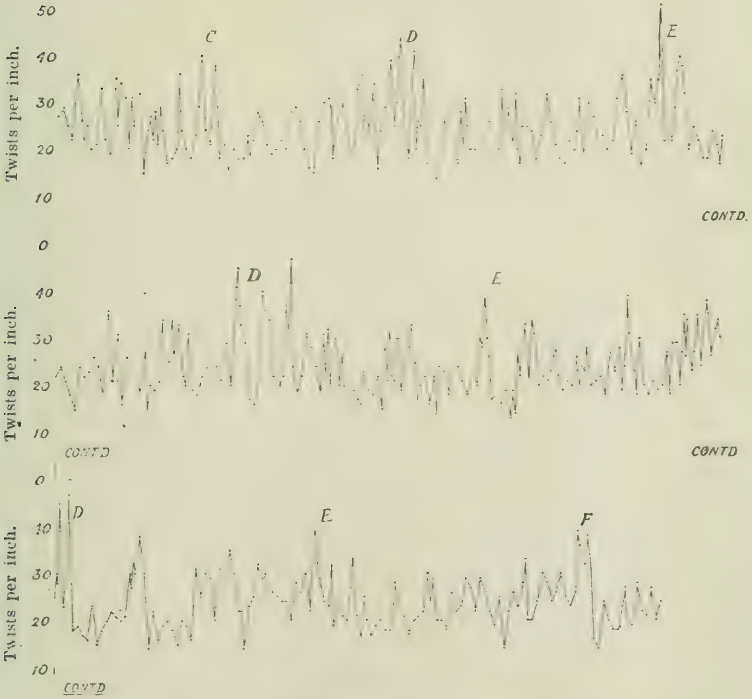
The horizontal distance between consecutive points = 1¼″ of Yarn.
Arrow indicates humidity reading.

of a more gradual rise in the twist if a maximum is approached from the left-hand side than if it is approached from the right. This is not as clearly defined as the corresponding effect in the tensile tests but good examples are shown in the periods A—B, C—D (second line), B—C (third line) in plate XXIV; C—D. and E—F in plate XXV. It should be pointed out that the yarn on which these tests were made was taken off the pulley after photographing and in plates XXIV and XXV the observations have been plotted backwards so that the curves should represent yarn taken from the cop. It will be seen that the more gradual slope as a peak is approached from the left as compared with the more abrupt fall on the right corresponds with the effects shown by the photographic and tensile tests in which the yarn was taken direct from the cop.

Similar results have been obtained with other mule spun yarns. These with the necessary data are recorded on plates XXVI—XXVIII.

PLATE XXV. (Contd. from Plate XXIV.)

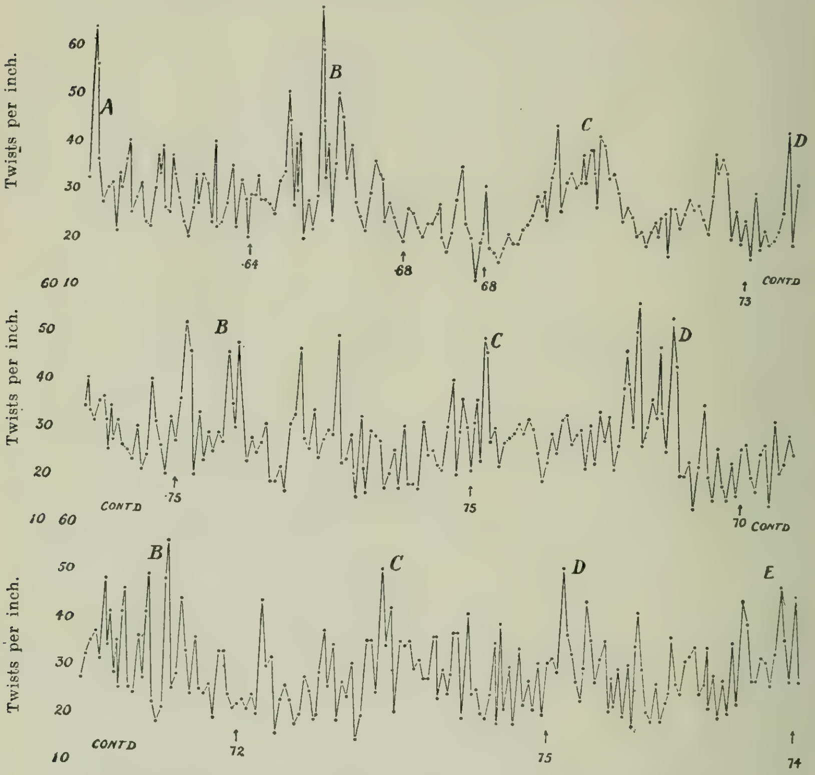
Cop No. 23 Contd. (see also Photographic Test No. 43, Plate I).



The horizontal distance between two consecutive points = 1¼″ of Yarn.

Plate XXVI.

Cop No. 19, Mule Spun, 175's (P.C.). This stretch of Yarn is the same as that photographed in Test 51 (see Plate IV).

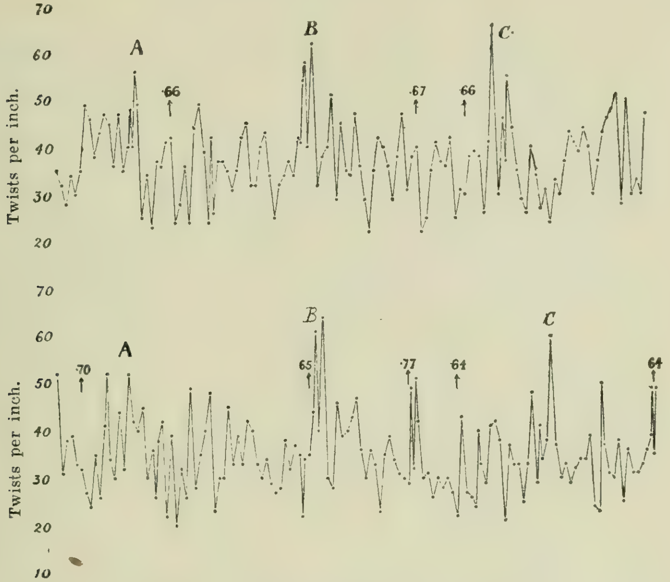


Horizontal distance between consecutive points = $1\frac{1}{4}''$ of Yarn.

The photograph of the same piece of Yarn (Test No. 51) is shown in Plate IV. Arrow indicates humidity reading.

PLATE XXVII.

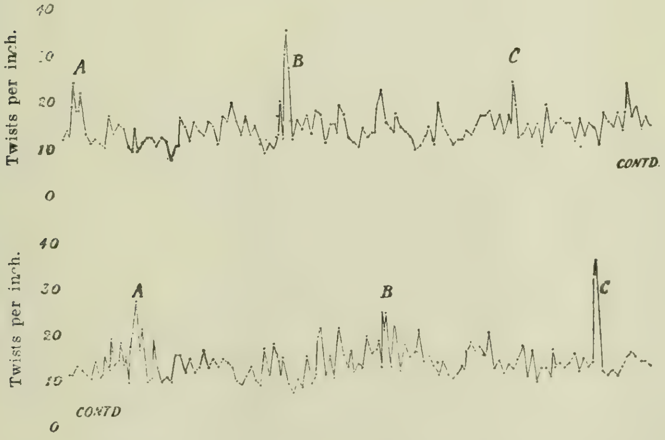
Cop No. 50, 200's superfine, Sea Island, Mule Spun. This stretch of Yarn was Photographed in Test 48, Plate V.



Horizontal distance between consecutive points = 1¼″ of Yarn.
Arrow indicates humidity reading.

PLATE XXVIII.

Cop No. 48, Mule Spun, 32's Weft, Twist way, 15 turns per inch.



The horizontal distance between two consecutive points = 1¼″ of Yarn.

4.—THE RELATION BETWEEN TENSILE STRENGTH AND TWIST.

The tensile and twist tests described above show that the peaks in the photographs correspond to elements of yarn having hard twist and high tensile strength. The relation between twist and strength had been examined independently in some preliminary experiments. For this purpose, a machine similar to that described on p.81 (Figs. 9a and b) was used in conjunction with the Baer single thread tester.

Starting with the yarn as supplied in cop form, 100 tensile tests were made, the specimens being each 5″ long. A second 100 test specimens were placed separately in the twist machine and the twist increased by definite number of turns, using a small motor fitted with worm gearing. The specimens were transferred to the Baer machine without any loss of twist and broken separately. Further batches of 100 samples were treated in the same way, each batch having a new number of twists applied.

A second series of tests was made, each test consisting of 100 determinations as before, but this time reducing the number of twists of the original yarn. The very small tensile strengths corresponding to the lowest twists could not be measured on the Baer machine. These specimens were broken by loading the pan P on the twist apparatus without removing the specimen.

Two yarns, American, having 13 and 10 turns per inch were investigated.

Cop No. 5, 13 Turns Per Inch.

No. of tests (single thread).	Mean tensile strength (ozs.).	Change of twist (turns per inch).	Actual twist (turns per inch
110	0·14	–6·78	6·2
100	0·48	–5·59	7·4
120	1·37	–4·53	8·5
120	2·90	–4·00	9·0
100	3·88	–2·52	10·5
60	5·65	–1·47	11·5
100	8·50	0·00	13·0
200	11·9	+3·15	16·2
100	15·7	+8·40	21·4
100	15·5	+9·45	22·5
100	17·9	+17·9	30·9

These results are plotted in Fig. 10, curve A.

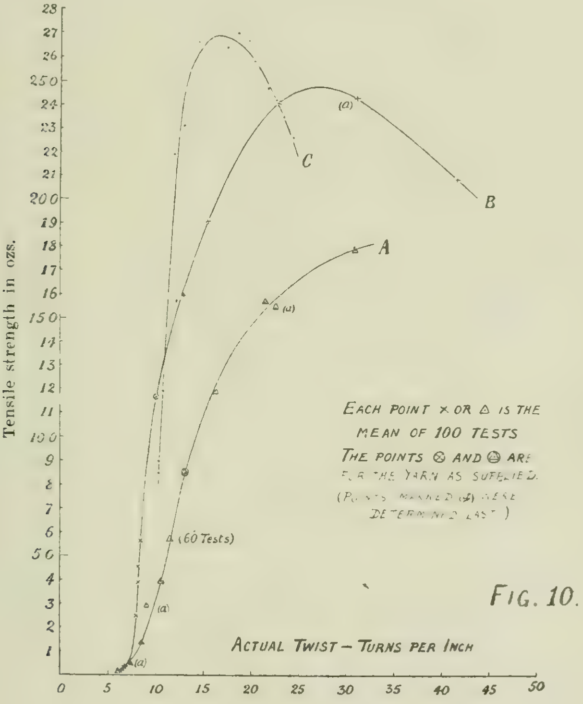
Cop No. 6, 10 Turns Per Inch.

No. of sests (single thread).	Mean tensile strength (ozs.)	Change of twist (turns per inch).	Actual twist (turns per inch)
100	·083	–3·69	6·3
100	0·124	–3.65	6·4
100	0·195	–3·28	6·7
100	0·336	–3·11	6·9
100	2·47	–2·13	7·9
100	4·59	–1·81	8·2
100	3·89	–1·74	8·3
100	5·65	–1·57	8·4
100	11·6	0·00	10·0
100	15·9	+2·94	12·9
100	19·1	+5.25	15·3
100	24·1	+12·6	22·6
100	24·3	+21.0	31·0
100	20·8	+31·5	41·5

These results are plotted in Fig. 10, curve B.

After the twist had been increased or decreased no attempt was made to condition the yarns. In this connection it is interesting to note that similar results have been obtained with conditioned yarns by C. H. Forsaith (*Textile World*, LXIII., No.7, p.31, 1920). His observations are confined to one type of cotton (referred to as No. 13) specially spun to 17 different counts, there being 20 bobbins of each count. A single thread Schopper testing machine was used to measure the tensile strengths, and the method of experiment was such that the bobbins were similarly conditioned and tested in such order that changes of humidity would have an equalising effect in the different tests. In the tests recorded above, the cops had been simply submitted to the same atmospheric conditions for several months. As regards the maxima of the tensile twist curves, there appears to be no difference between the *type* of Forsaith's curve, which is reproduced at C in Fig. 10, and the curves A and B.

FIG. 10.



The curves show that increase of twist beyond that of the normal yarn produces an increase in the tensile strength, and this continues, though at a slower rate, up to a certain limiting point beyond which further increase of twist lowers the tensile strength. This latter effect is not necessarily caused by loss of fibre strength. It could arise from the oblique inclination of the individual fibres in the highly twisted specimens. That this is so is shown by the following experiments made on a yarn, 100's w. combed, 28·9 turns per inch, mule spun from Egyptian cotton (cop 23). Column 1 gives the means of 5 sets of 20 tensile tests for the normal yarn which has 28·9 turns per inch. Columns II., III. and IV. are the corresponding mean tensiles when the twist has been increased 25 turns per inch, 50 turns per inch, and when 50 turns per inch have been added and removed, respectively.

It will be seen that increase of twist increases the tensile strength considerably in Column II., but the increase for an additional 25 turns per inch is only slight. This implies the existence of a maximum as shown above.* It is probable that the fall off in tensile strength accompanying this high twist is not due to injured fibres, for the results of Column IV. show that when the 50 excess turns per inch are abstracted the yarn has acquired its original tensile strength to within a few per cent. This would not be expected if the fibres had been permanently deformed or broken.

	I.	II.	III.	IV.
	2·96 ozs.	4.37 ozs.	4·52 ozs.	2.66 ozs.
	2·75	3·90	4·05	2·52
	2·76	4·31	4·45	3·12
	2·52	4·22	4·26	2·90
	2·88	4·21	4·10	3·12
Means	2·77	4·20	4·28	2·86

When the twist is decreased below that of the normal yarn, the tensile strength falls off almost linearly with the amount of twist taken out, and this holds until about three-quarters of the original twist is abstracted. Still further reduction of the twist causes a decrease of tensile strength, though at a lower rate for very small twists. In this region we are confronted with a new problem depending on fibre friction, a property not only of the convolutions of the individual fibres but of the waxes on their surfaces. It is intended to return to these points in a later investigation.

In the photographic and twist tests recorded in the present paper, the peaks correspond to high twists. These are considerably higher than the mean twist or that calculated from the counts, but the experiments of the present section show that they are not so high that their presence has a weakening effect on the yarn. In some of the yarns examined there are local excess twists ranging from 100—150% above the mean twist, and in such parts of the yarn there is a danger that the maximum tensile strength has been passed. In spite of this, the yarn may still have a higher tensile strength at these points than if it had merely the mean twist, but the real disadvantage of such high local twists, apart from the accompanying unevenness of the yarn, is the readiness to form snarls without any advantageous gain of strength, for the strength is determined by the weakest element of the stretch taking part in a given operation. This unevenness of twist is a further source of danger in calculating the twist inserted in a yarn from the length of yarn put up per draw and the number of revolutions of spindle per draw. Since a large amount of twist is absorbed locally in the yarn, the intervening lengths will have less than their due proportion of twist unless a factor of safety is allowed which is sufficient to bring the minimum twist up to the amount required to give the necessary tensile strength to the weakest parts. The result of applying this precaution would cause excessive twist to accumulate periodically along the yarn, with the disadvantage of an increased tendency to snarl at definite intervals, a tendency evidenced by a number of the mule yarns examined.

5.—ANALYSIS OF THE ABOVE RESULTS IN RELATION TO THE MECHANISM OF THE MULE AND RING FRAME.

1. *Mule Spinning.*—The intermittent action of the mule may be divided into four parts :—(1) Drawing and twisting, during the outward run of the carriage ; (2) backing off, during which the open spirals of yarn between the nose of the cop and the spindle tip are unwound ; (3) winding, during the inward run of the carriage ; this may be conveniently divided into two parts

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* These tests have since been extended and a maximum similar to those shown in fig. 10 has been obtained.

determined by the downward motion of the winder faller during crossing and the slower upward motion of the winder faller during the latter and greater part of the inward run of the carriage; (4) re-engaging, when the winder faller rises and causes a few open spirals to be wound on the spindle between the nose of the cop and the spindle tip. The motion of the counter faller wire serves to direct the yarn on to the winder faller during the operation of winding and at the same time takes up the slack induced by the backing off motion.

While the carriage is making its outward run, the spindles are revolving at their greatest speed and at the same time roving is being delivered by the draft rollers. During winding, it is usual to continue a small roller delivery even though no twist is now being put into the stretch. The reasons for this are (1) to relieve strains in the stretch which is bent round the faller wires as the carriage runs in, (2) to increase production. Now twist is fed into the roving delivered by the rollers from the remainder of the stretch and, assuming that a certain constant percentage of the total number of twists in the available stretch is transmitted to the roving delivered in one second, it is easily seen that the twist transmitted to the element of roving delivered in one second when the carriage is just commencing its inward run will be greater than that transmitted when the carriage is nearly at the end of this run. The result is a tendency for a lower twist to appear near the roller nip at the end of each draw. In the following draw, the *last* part of this low twisted region finds itself at the spindle tip, where it is in the best position to receive the maximum twist directly. A periodic variation will be produced, a soft twist being followed immediately by a hard one as the yarn is wound on the cop. A jacking motion device would tend to counteract this effect.

Apart from roller motion during winding, it is probable that a non uniform distribution of twist will exist in each draw, particularly in low twist weft, on account of fibre slip followed by permanent set in the yarn. It is likely that a high twist per unit length is *forced* into the yarn near the spindle tip before the fibres have a chance to slide into their equilibrium positions. Under this rapid twist from the spindle the normal pressure between the pairs of fibres increases and, for a given coefficient of static friction, they have a less tendency to slip. This local high twist is maintained by the spindle throughout the draw, although the element is continuously transmitting twist to the gradually increasing stretch of yarn. The process by which the latter takes up its twist is of a more steady nature than that occurring near the spindle, and the chance of slip between pairs of fibres is greater because the normal pressure between the fibres never rises to the high value it has near the spindle. Successive elements of yarn tend, therefore, to transmit less twist towards the rollers. The device of twisting at the head does not appear to overcome this difficulty, at least in low twisted weft. Double speed driving while twisting at the head may even act the other way.

Thus the twist will fall off between the spindle tip and the roller nip, the law of decrease being some function* of the length of draw, the internal pressure between the fibres and their coefficients of static and dynamic friction. In an actual yarn this will be further complicated by irregularities in the individual fibres and in the variation of the number of fibres in different cross sections of the delivered roving. The extent to which slip takes place during spinning is unknown, but the photographs shown in plates I., II. and in Fig. 5 indicate that the hardness of the yarn decreases asymptotically between the spindle and rollers. In the higher counts, 175's and 200's, the hardness falls off almost linearly between the same points.

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* This has now been determined from the twist and fibre numbers of the individual twist test pieces.

In either case, theory and experiments show that in mule yarns a periodic variation of hardness exists. Superimposed on these periodic irregularities, due to roller motion and fibre slip, are spurious variations due to irregularities in the roving. If the roving is uneven, the transmitted twist will tend to run into the thin places rather than the thick ones. The thin places thereby become stronger, so that any further attenuation which takes place during the draw must occur in the thicker and weaker places. These, in turn, after being attenuated, will receive more twist and by so doing will become stronger and more resistant. This process of drawing and twisting in a long stretch no doubt explains why irregularities due to unevenness of roving are more completely smoothed out in mule than in ring spinning (p. 97), though the effects of knotted fibres would persist in either case.

It might be expected that during the process of backing off, some of the excessive twist near the spindle tip would be transmitted to the length of yarn of low twist released from the spindle, and probably this is the case to some extent, but the action of the counter and winder faller wires in taking up the slack will tend, by the pressure they exert on the yarn, to prevent this, and the yarn becomes wound on the cop before this pressure is relaxed. How small a lateral pressure will hinder the transference of twist is well seen when the free end of a newly-cut piece of yarn is lightly pressed on a bit of rough wood. No twist will be lost, though the end if left free is seen to spin round several times. The length of yarn released from the spindle during backing off will therefore have a lower twist than the adjacent portion resting on the counter-faller, for during the previous draw the former length was near the rollers where the transmitted twist is lowest.

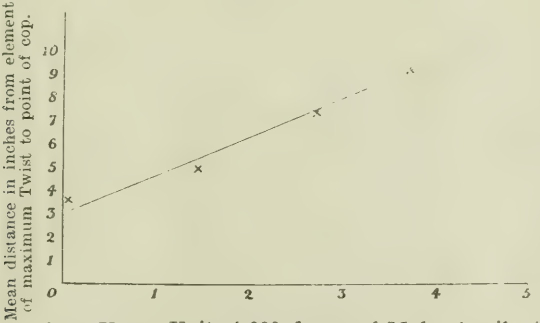
When crossing commences, a few (5 or 6) turns of yarn are wound on the cone of the cop from the nose downwards, and it follows therefore that the yarn immediately near the nose of the cop will have a softer twist than a portion lower down the cone, the latter of course being the portion which was at the spindle tip during the last draw. The maximum twist will be found in the crossing, and, in the remainder of the winding, as the winder faller reaches its lowest position and slowly returns to the level of the nose of the cop, the twist of the yarn will gradually fall off. Suppose at the end of the winding operation the yarn is broken and then unwound from the cop. It will pull off in turns gradually increasing in diameter as we pass from the nose to the base of the cone. Then the crossing will be unwound, the hardness of the yarn all this time increasing until a maximum is reached at some point in the crossing, after which the hardness will quickly fall and remain low until the nose of the cop is reached and a complete draw has been taken from the cop. In the photographic, tensile and twist tests described in this paper we can trace this variation in the hardness of twist throughout each complete draw of the mule carriage.

Plate V. is a photograph of a yarn, 200's count, spun from Sea Island cotton. Travelling along the photograph marked A from left to right, a start is made approximately in the middle of a draw at X, and from this point the photographic trace rises slightly to Y, three inches along the photograph or 24″ along the actual yarn. (The contraction factor is 8 and 1″ on the photograph = 8″ of yarn.) The photographic paper was drawn through the camera in the direction Y to X, and the rise of the trace between X and Y implies an increase of hardness of the yarn as the cop is unwound (see Fig. 5). While the photograph was being taken, visual observation of the yarn and beam of light were made, and the highest point of the trace corresponded to an element of yarn in the crossing, but quite clear by a few inches from the nose of the cop. As soon as this hard piece had passed through the shoes, there was a sudden drop in hardness, and this remained low for that portion of yarn which is wrapped on a small diameter near the nose of the cop (and which during spinning was wrapped round the bare spindle). This drop in hardness is shown at Z. Continuing unwinding from the cop, the hardness now gradually increases as we pass from the nose to the bottom of the cone and up again to a point on the new crossing where the hardness again reaches a maximum. Then there is a quick drop in hardness as before. This second draw is represented by the letters X_1, Y_1, Z_1. If the right end of photograph A is placed to the left of B, nearly six complete draws of the mule are shown. Photograph C is a continuation of the same specimen of yarn after an interval of about 20 yards. It shows similar characteristics to A and B, and though there are spurious irregularities, *e.g.*, those at S, which are due to slubs, it cannot be denied that there is a decided periodic hardness forced on the yarn by the intermittent mule mechanism. The period is 7″ on the photographs, and this corresponds to a 56″ draw of the mule carriage.

Near the nose of the cop the yarn has its minimum winding diameter, and when the yarn is unwound it is usually found that this small winding diameter has impressed a curliness on the yarn which, however, may easily be removed by applying a small tension. It was observed that when these curly portions slid between the shoes the spot of light oscillated over a small amplitude. At these places the photographs show that the yarn is softer, and a visual examination usually shows that it is also "fuller." Both observations imply that the twist is low. The maximum hardness was always found in the crossing (well away from the curly portion at the nose of the cop), and a visual examination showed that where it occurred the yarn usually appeared very thin. Here, both observations imply that the twist is high. These results were confirmed in all the tensile and twist tests. As the cop grows, the length of yarn between the point of the cop and the spindle tip decreases. If the above view is correct, the distance from the point of maximum twist to the point of the cop should also decrease as the cop is built up and increase as the cop is unwound. This has been tested on cops 24 and 25, spun from 16 hank combed roving, 102's doubling weft, 28·9 turns per inch. In the following table the distance along the yarn is given in complete draws, and D is the distance from the element of maximum hardness to the point of the cop. Each value of D is the mean of 20 maxima determinations each involving 18 twist readings, *i.e.*, 360 twist measurements.

Cop No.	Distance along yarn in draws.	No. of twist measurements.	Number of maxima.	D
25	40	360	20	3·6″
25	1415	360	20	4·9″
24	2665	360	20	7·4″
24	3640 = 3¾ miles	360	20	9·3″

FIG. 11.



Distance along Yarn—Unit=1,000 draws of Mule=1 mile (nearly).

These results are plotted in Fig. 11. It is seen that D increases linearly as the cop is unwound, the value being 3·6″ near the nose of the new cop and increasing to 9·3″ when 3¾ miles of yarn have been unwound. Cops

24 and 25 were spun together, and both came from the wheel end of the mule. A similar result was obtained with cops 48 and 49, 32's weft, 15 turns per inch, spun at the same time from Egyptian cotton. These cops were shorter than the previous ones, and 720 twist measurements involving 20 maxima at the top of the cops and 20 at the bottom gave D (top) = 3·7″ and D (bottom) = 6·0″. Confirmation of this was obtained from two sets of tensile tests each involving 600 readings and covering 100 maxima. For cops 48 and 49 the values of D were 3·1″ (top) and 5·7″ (bottom), which is in good agreement with the twist tests. Similar results have been obtained with cops 33 and 34, spun from 8 hank carded roving, 32's, 15 turns per inch, the values of D being 4·4″ and 3·8″ (top) and 6·4″ and 5·6″ (bottom) respectively, each number being the mean of 600 measurements. From these results there is no doubt as to the origin of the periodic unevenness of mule-spun yarns. In plates III. and IV., representing a sample of 175's Sea Island yarn, the periodicity is very distinct. One might almost superimpose a diagram of the mule on these photographs. If we imagine that (*a*) is the tip of the spindle, (*b*) the nip of the draft rollers, (*c*) the counter faller wire, and (*d*) the winder faller wire, the mechanism of the mule can be followed from the photographs. At the beginning of a draw (photograph A) (*a*) (*c*) and (*d*) are close to (*b*), the faller wires being clear of the yarn. As the carriage moves out (photograph B), (*a*) (*c*) and (*d*) move to the right while the fixed rollers (*b*) deliver the roving. During this motion nothing happens to the yarn immediately to the right of (*a*); it is wound in loose spirals on the spindle, and takes no twist from the revolutions of the latter. But between (*a*) and (*b*) twist is being inserted by the revolving spindle, the twist being always highest near the spindle tip (*a*). At the end of the draw, the backing off motion starts; (*a*) (*c*) and (*d*) have stopped moving to the right, the counter faller (*c*) has risen and the winding faller (*d*) fallen, and in doing so have taken up the slack produced by backing off. It should be noticed that this length of yarn which is backed off from the spindle was at the commencement of the draw immediately to the right of (*a*) in photograph A. It has there a very low twist and, since no additional twist has been given to it during the draw on account of its being wrapped round the spindle all the time, it still has a twist lower than that of the yarn in the draw between (*a*) and (*b*). During the winding motion, (*a*) (*c*) and (*d*) move back to the rollers (*b*). The soft twisted yarn between (*c*) and (*d*) forms the first part of the crossing which is completed by the harder twisted yarn from just to the left of (*a*) (photograph C). The winder faller is now near the base of the cone and the remainder of the draw, whose twist is gradually falling off, is wound on the cop in a large number of turns from base to nose of the cone, the latter point being reached when (*a*) has travelled back to near (*b*). The winder faller now wraps the low twisted yarn between (*a*) and (*b*) round the spindle, and both winder and counter fallers move clear of the yarn for the commencement of the next draw. The relative positions of the hard and soft twisted elements on the cone during crossing thus agree with those determined from the photographic, twist and tensile tests recorded above. Moreover, the steepness of the photographic trace to the right of a maximum as compared with that to the left is inversely proportional to the length of yarn backed off the spindle to the length of yarn in the draw.

2. *Ring Spinning.* A number of tests, photographic, tensile and twist, have been made on ring spun yarns. The results, shown in plates VIII.—IX., XIV.—XVIII., do not indicate that ring spinning introduces any definite periodicity into the yarn. The lateral magnification in the photographs is 2224, the same as for the photographs of all the mule yarns so that the ordinates of the curves are at once comparable. It will be seen that the irregularities are of the same order of magnitude for ring and mule yarns though they are of a different character. In ring yarns, the irregularities appear to be due almost entirely to chance variations in the delivered roving,

and no periodicity due to this type of spinning mechanism is obvious. Apart from the irregularities which occur periodically in mule-spinning, mule yarn is more even than ring yarn, and this is attributable to the length of draw of the mule carriage as explained on p.94. The relatively short distance between the draft rollers and the traveller in the ring frame and the greater speed of the yarn do not admit of so efficient a smoothing out of the irregularities inherent in the roving as in the case of the long and slower draw of the mule. The thin places in the roving take up twist rapidly, the thicker places receive less. The slight tension in the yarn tends, therefore, as in the mule, to draw out the thicker places, but before an equalisation of twist has taken place the yarn becomes wound on the bobbin and retains there some of the unevenness which would have disappeared had the interval for twisting been longer. It is conceivable that a small periodic irregularity may be introduced into ring yarn through the rise and fall of the ring plate which gives the building motion to the bobbin. At the bottom of its traverse, the stretch of yarn being twisted is longer than at the top; therefore, from the mid-point of the traverse downwards and up again to this point, the stretch is longer than in the upper part of the ring plate motion. Assuming the spindle speed and roller delivery to be constant, this should confer on the yarn a waviness of twist hardness in an interval of about 350 inches. Further, if a twist variation arises from inconstancy of traveller speed, it would also coincide with this period, for the traveller makes a larger number of revolutions when the winding diameter is large than when it is small, and the period of this variation coincides with that of the motion of the ring plate. But with a spindle speed of 9,000 R.P.M. it is known that for normal bobbins, of maximum diameter $1\frac{3}{4}''$ and minimum diameter $\frac{7}{8}''$, the variation of R.P.M. of the traveller does not amount to more than 1% of the spindle revolutions, and it is not probable that variations of twist due to this cause could be isolated directly. The presence of much graver irregularities in the roving, not smoothed out by the small draw of the ring mechanism, leave non-periodic irregularities which entirely outweigh this effect.

6.—EFFECTS OF THE IRREGULARITIES AND SOME SUGGESTIONS FOR ELIMINATING THEM.

(*a*) *Weaving Effects.*—The presence of periodic irregularities is liable to give rise to barring in woven fabrics. This visual effect is partly due to the fulness of the yarn which has a low twist and comes from the neighbourhood of the nose of the cop, and is accentuated by the adjacent thin element of high twist. The barring will be most conspicuous when the distance between the selvedges is equal to or a simple fraction of the draw of the mule, but, even if this is not so, more or less irregular patterns may be formed. A sample of fabric woven from weft similar to that of cops 48 and 49 (32's weft), the distance between the selvedges being 29″, *i.e.*, approximately half the draw of the mule, showed, under favourable illumination, very distinct barring. In this case the fuller intervals of yarn were echeloned, the full and thin threads being laid down alternately. It seems impossible with periodically irregular yarn to avoid the appearance of visual barring sooner or later as the weaving progresses, but serious effects may be avoided by so choosing the width of loom in relation to a known draw of the mule that the periodic unevennesses are distributed as far as possible in a random manner over the entire fabric. A far more satisfactory solution of this difficulty would be to remove the periodic unevenness from the weft yarn by some modification of the spinning process. A possible means of doing this has been suggested, and the work is in progress.

Barring effects are mainly due to weft of low twist (primarily for filling purposes). Warp yarns, having a relatively high twist, do not offend seriously in this respect. In their case *the essential point of regularity is to secure uniformity of strength so as to avoid an undue number of breakages* as weaving proceeds. Their twist should be as uniform as possible and correspond to the region near, but to the left of, the maxima shown in Fig. 10.

It would appear that where coarse fabrics are being woven, ring yarns are more suitable than mule yarns; for the irregularities they possess are not periodic, and on this account are less liable to produce barring.

(*b*) *Knitting.*—In knitting yarn, the desideratum is a uniform fulness so that raising is uniform. This demands a uniform twist in low twisted weft, which in knitting constitutes the entire fabric. In medium and high counts, the necessary uniformity of twist does not appear to be attainable with the present mule mechanism. The presence of twist irregularities is detrimental (*a*) because in the brushing and finishing operations the hard and soft twisted elements do not respond equally, thus giving the fabric a mottled appearance, and (*b*) because such twist irregularities are accompanied by variations in tensile strength and the breaking of a single thread starts a minute hole which quickly spreads in any direction as each loop loses its support. The problem of manufacture is more difficult than that involved in the case of ordinary cotton fabric. Only one type of yarn is used to make the fabric, and this must be of low twist to preserve fulness and yet be of sufficiently high twist to be serviceable. It is clear that *only by endeavouring to produce the most uniform yarn possible can these practically opposing qualities be combined to give the best results.*

SUMMARY.

The regularity of the hardness of a selection of yarns varying in counts from 32's to 200's has been recorded photographically by the special apparatus described on pp. 55-59. The magnification of the photographic trace, which represents the top surface of the yarn under compression, is obtained mechanically and optically, the highest value used being 17900 (though still higher magnifications may be obtained). The yarn is drawn between a pair of case hardened shoes and subjected to a normal pressure of $2\frac{1}{2}$ozs., which smooths out the stray fibres, and it is the apparent diameter under these conditions which is measured. This diameter is primarily dependent on hardness of twist and secondarily upon fibre concentration and fibre regularity. Direct evidence of a periodicity of twist hardness has been obtained in all mule yarns so far examined. This is due to the intermittent action of the mule mechanism. The secondary factors mentioned above influence the regularity of hardness, but not periodically. In all cases the periodic intervals correspond to the length of mule-draw, and details for different yarns are recorded above. The ring yarns examined show only non-periodic unevenness.

The photographic tests have been controlled by tensile and twist tests on successive elements of yarn and by an investigation of the relation between tensile strength and twist.

The origin of the unevenness is discussed in terms of the mechanism of the mule and ring frame.

The present method of testing yarns has the following advantages over those hitherto used :—It is (*a*) continuous, every element of the yarn being subject to test, (*b*) capable of very high magnification, (*c*) useful for obtaining permanent records, (*d*) rapid and automatic, (*e*) not a test to destruction, the yarn being available for other tests.

The laborious series of tensile and twist tests recorded in this research are due almost entirely to Mr. T. B. Partington, while the supplementary tensile and twist tests recorded in Fig. 10 were made by Mr. H. B. Williams.

THE STRUCTURE OF THE COTTON HAIR AND ITS BOTANICAL ASPECTS.

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INTRODUCTION.

Whilst a knowledge of the exact structure of the cotton hair must be the basis of any research into the constituents and properties of cotton, or of any intelligent application of the many processes which it may have to undergo in the manufacture of yarns and fabrics, it is remarkable how little original work has been done in this connection. The literature of the subject is at best scanty, with a regrettable amount of uncritical repetition and plagiarism. Among the advances into knowledge of the origin and development of the cell wall, made in the past fifty years, the possible bearing of much scientific work on the structure of the cotton hair has been overlooked; and whilst modern biological research has been profoundly affected by work (which its commercial importance has made possible) on the physiology and the genetics of the cotton plant, there are still many gaps to be filled in where the structure and properties of cotton itself are concerned. These gaps, however, are recognised, and in the past fifteen years much has been done to increase our knowledge of the manner in which the wall is built up, amplifying and within limits confirming the teaching of technologists of the last century, and even supplying older scientific hypotheses of wall formation with incontrovertible proof.

This paper aims at giving as briefly as possible a resumé of existing information on the structure of the cotton hair, and of such parallel instances in general botanical literature as can be used to throw light upon it.

HISTORICAL.

The earliest reference to the microscopy of cotton is frequently given as the work of Thompson,[1] of Clitheroe, who in 1834 employed two artists to make drawings in illustration of a paper on the mummy cloths of Egypt, afterwards made use of by Yates.[2] Cotton, however, had been examined under the microscope as far back as the end of the seventeenth century by Leuwenhoek[3] (1678), and its characteristics roughly described; and another reference which deserves priority is given by Butterworth,[4] of Oldham, who in 1881 quoted an anonymous authority of some 65 years before, who recommended the use of the microscope in mills—perhaps the first suggestion of technical microscopy. " Whoever will examine the finest cotton fibre with a glass will find it enclosed in a coat as compact as the stubborn oak is enclosed within its bark; and if that coat is broken into it will produce a roughness along the fibre, and its strength will be greatly diminished." This is the first mention of the cuticle. Ure[5] in 1836 could write : " The filaments when viewed in a good achromatic miscroscope appear to be for the most part riband formed or flattened cylinders, with a thickened list at either edge, and veins of embroidery running along the middle . . . whether a cylinder or a riband the cotton fibre is never straight, but is either twisted right or left or coiled like a corkscrew . . . there are no feathery margins as some writers have described . . . ." He thus described both convolutions and striations, though the nature of the " feathery margins " must be left to conjecture. The paper gives drawings of Sea Island, " religious," Surat and Smyrna cottons, which do the author credit.

Crum[6] writing from 1843-1863, mainly on the subject of dead cotton and the effect of dyeing on the hair, figured longitudinal and transverse sections of cotton in various stages of maturity and in the dyed state. He described the structure of the hair as being a sheath enclosing a deposit of cellulose, with a central canal containing what is now known to be dead protoplasm, discrediting the earlier idea of a hollow tube filled with air and more or less collapsed. In one of his drawings are shown rings which he took to be microscopic diffraction effects, but which have since been suggested by Willows and Alexander[7] to be the growth rings described by Balls[8].

As far as can be known, O'Neill[9] was the first worker to apply the swelling treatment to the elucidation of the anatomy of the hair. Using " cuprammonium " he was able to differentiate four regions : " First, the outside membrane, which did not dissolve in the copper solution. Second, the real cellulose beneath, which dissolved, first swelling out enormously and dilating the outside membrane. Thirdly, spiral fibres, apparently situated in or close to the outside membrane, not readily soluble in the copper liquid. These were not so elastic as the outside membrane, and acted as strictures upon it, producing bead-like swellings of a most interesting appearance; and, fourthly, an insoluble matter, occupying the core of the cotton hair, and which resembled very much the shrivelled integument in the interior of quills prepared for making pens." Similar results were obtained by the use of sulphuric acid or zinc chloride, but the effect on bleached cotton was not the same, owing, he supposed, to the absence of the integument or the removal of some protecting substance.

In France, contributions to the study of the structure were made as early as 1875 by Schlesinger[10] and in 1876 by Vetillart[11]. The latter description is noteworthy for its excellent drawings, and for a discussion of the striations which, so Vetillart concluded, are not of the nature of cracks or slits in the cuticle. The presence of brownish matter adherent to the hairs, which he described, seems to have escaped the notice of later writers.

The work of Grothe[12] is of interest chiefly for his description of the large number of species, besides cotton, bearing hairs which might be of use in the textile industries. His work, of a purely technological character, is interesting as the precursor of a particularly uninspired type of handbook which has since found large circulation in Germany. Such names as Spennrath[13], Zitsche[14], Witt[15] and Pietsch[16] may be noticed in this connection.

In 1881 Bowman[17] began to deliver a series of lectures on cotton, which have since been printed and reprinted, and are still a standard text. His example was followed by Monie[18] in 1890, covering very much the same ground. More information can be found at this date in the work of Hanausek[19] and Nebeski, and can be more conveniently consulted in the former author's " Microscopy of Technical Products "[20]. In 1887 the first edition of Höhnel's[21] work on the microscopy of technical fibres was published, which, though largely dependent on Bowman, contained a major proportion of original data which in conjunction with Wiesner's[22] text book of plant products is still of very material use.

In America the encyclopædic *Bulletin*[33], issued by the U.S. Department of Agriculture[23] (1890) correlated most of the existing information on cotton in all its aspects, the anatomy of the hair being discussed by Evans. Brooks[24] (1898) gives perhaps the first critical discussion of the anatomy of the wall, and his work deserves wider recognition than it has received.

This closes the general literature of cotton for the last century, and subsequent writers will be referred to as the need arises.

DEVELOPMENT.

Cotton as received in Lancashire is little more than a mummified form of the living cell from which it is derived, and for this reason alone it is advisable to begin any examination of its structure *ab ovo*, or at least from the ovule and the development of the hair from the seed coat. The process has been described by various writers, such as Bowman[25], Monie[26] and

Flatters[27], with drawings and microphotographs, but the following description given by Balls[28], [29] is the only precise record of a phenomenon of the greatest importance. (For an excellent figure showing the relation of the hair to the seed coat, Hanausek[30] may be consulted.)

" The ordinary epidermal cell of the outer ovule coat has a thick basal wall separating it from the sub-epidermal layer, thinner side walls, a thin cuticle covering the outer wall and dipping slightly between the side walls, with a nucleus which is about one-fifth of the length of the cell, and small sap cavities in the protoplasm. The outer wall of some of these cells bulges, their protoplasm becoming densely granular in the protuberance, while the nucleus moves up closely behind these granules. The swelling enlarges to about twice the diameter of the original cell, and the nucleus passes out into it with all the chromatin retracted into a large, deeply staining central nucleolus. The nucleus keeps at a short distance behind the tip of the swelling or hair, which continues to elongate at the rate of about 1 millimeter a day, which may be expressed in terms of diameter as about twice the diameter added to the length on the average every hour. It is almost certain that in the case of Egyptian cotton this elongation is not continuous but is intermittent during sunshine in the same way as the growth of branches or stem. The nucleus at a later stage appears to settle near the centre of the fibre, about one-third of the way from the tip : the cell wall remains extremely thin for the first three weeks, and the cuticle which still covers it can scarcely be differentiated, unless the wall has been swollen by Schweitzer's reagent. . . ." (See Figs. VII. and VIII.)

Thus the lint hair itself is a simple unicellular trichome ; the full diameter is attained almost at once in its growth, when it is only 0·1 mm. in length, while its length continues to increase until the twenty-fifth day of development, after which the secondary thickening is laid down concentrically and centripetally. The cell contents remain alive until the boll opens, when they die through desiccation.

The hair falls naturally for examination under the following headings :—

1. General conformation.
2. Primary wall.
3. Secondary thickening.
4. Central canal (lumen) and contents.

Other points for discussion are :—

5. Pits in the hair wall.
6. Spiral markings and striations.
7. Convolutions.
8. Abnormalities, including " Dead Cotton."

(I.) *General Conformation.* The variation in size of cotton from different sources has naturally been the subject of much attention, and every text book of any pretensions devotes a number of pages to tables of hair length, diameter, and general characteristics. Some writers, such as Evan Leigh[31] and Bowman[32], give maxima and minima, others (Höhnel[33], Hannan[34], Matthews[35], etc.) give only mean measurements. Bowman[36] also gives a table of the extreme variation in length and diameter of different cottons.

Such tables are, in practice, of questionable value : unless a large number of hairs are measured, and the results plotted as a frequency polygon and discussed statistically, the observations are of little worth. A machine has recently been designed by Balls[37] which automatically sorts out a sliver into hairs of the same length, but no such machine has been constructed to measure diameters of hairs even approximately. Measurement of hair length is complicated by the presence of convolutions, and the length generally taken is appreciably shorter than that of the hair under tension. Diameter is even more difficult to measure, and it is at best a tedious and uncertain operation. A paper by L'Amie and Harland[38], which lays stress on these difficulties, deserves consultation. The hairs to be measured are seldom cylindrical in cross section, but a more or less flattened ribbon, thicker at the edge than the centre, sometimes crescentic or even more irregular in section, while existing methods of cutting sections are all more or less capable of altering the consistency of the wall, introducing an unknown and inconstant error. The use of the word " diameter " should be reserved for the original cross section of the uncollapsed hair, and " ribbon width " and " wall thickness " used in its place for hairs in the desiccated state. (Fig. IV.)

This difficulty in measurement perhaps accounts for the curious differences in Wiesner's[22] table of thickness at different points along the length of single hairs, although fundamentally there is no reason for expecting a hair to develop at a constant diameter under varying conditions of turgor pressure due to its environment. (See Fig. XI.)

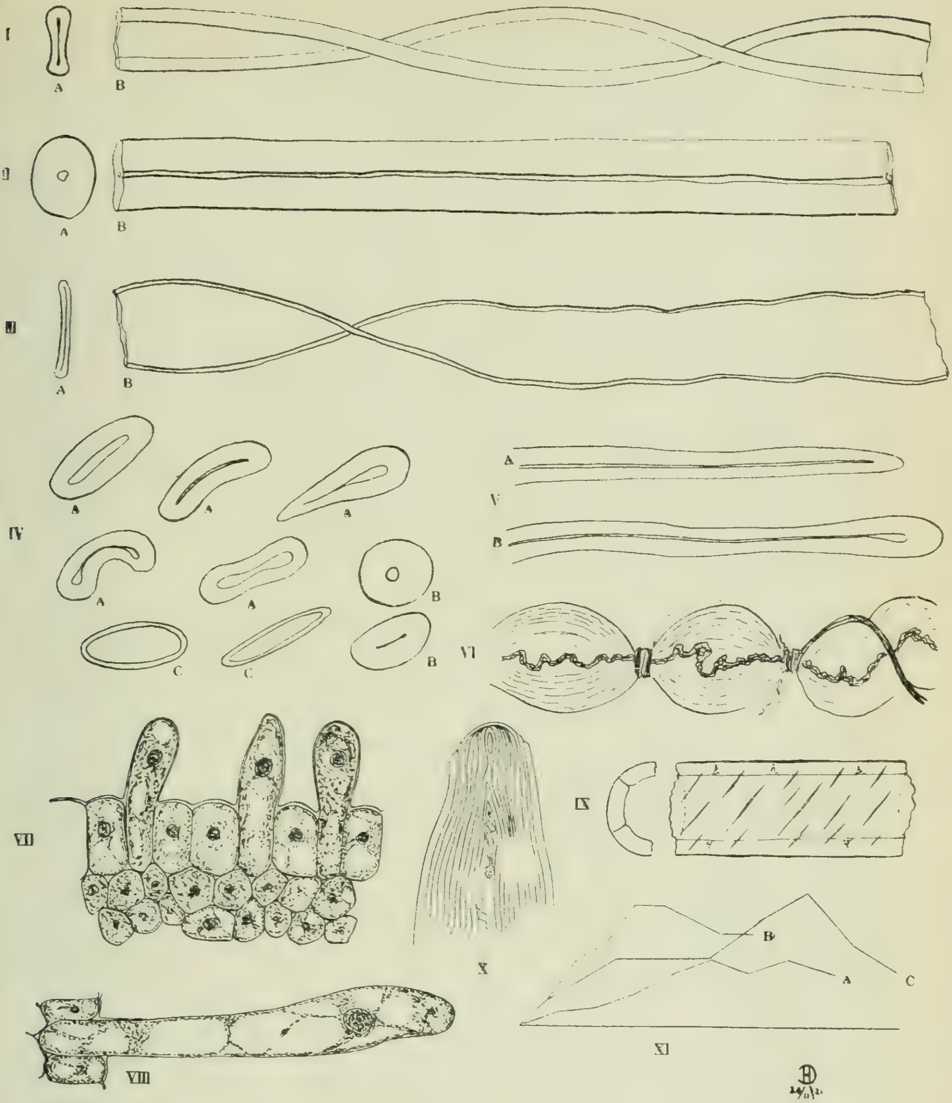
Much space in the earlier literature was taken up by attempts to differentiate the varieties of cotton microscopically, but the modern tendency is to abandon the method on account of its uncertainty and the risk of environmental variation. Haller[39] has even questioned its possibility, and has devised a method of diagnosis by means of the leaf fragments present in the uncarded material.

Many varieties of cotton exhibit a marked " tail " towards the apex, particularly the finer and longer staples. These tails have no convolutions, and practically no central canal or lumen, the space being almost filled by the secondary thickening. The apex itself may exhibit various shapes, acutely conical, blunt ended, spatulate, or club shaped[40] (see Fig. V.), though little is known as to its exact structure. These tails are said by some manufacturers to break off in the various processes preparatory to spinning. but confirmation of this opinion is required, as it would probably be possible to modify the tendency by genetic selection.

(II.) *The Primary Wall.* The cells of the epidermis of most plants have the outer wall differentiated into a cuticle and secondary thickening, the cuticle being usually possessed of properties which make it resistant both to wetting and desiccation, thus acting as a protecting layer to the whole plant. The cuticle is impregnated with substances of a fatty nature, to which the term " cutin " has been applied. It is not within the scope of these notes to discuss the nature of cutin, but reference may be made to a recent contribution by Priestley[41] and to the earlier work of Van Wisselingh[42].

The cotton hair shares the above characteristic. The cuticle proper in normal, untreated hairs is indistinguishable from the primary wall which is laid down during the growth in length referred to above. In comparison with the types shown in text books of anatomy, it is extremely exiguous and cannot be distinguished at sight in a transverse section. The usual method of demonstrating its presence has been mentioned above, but it can also be differentiated by stains which have a selective affinity for fatty substances, such as Scharlach-R.

Whether the substance which is present in the outer wall of cotton can be included under the generic term of cutin is a problem for chemistry. Its exact nature is unknown, and research on the subject is awaited. It is certainly of a waxy or fatty nature, resistant to acids and cellulose solvents, whilst susceptible to the action of alkalis, which are said by Haller[43] to cause its disappearance in the process of mercerisation. The cuticle has long been recognised as very liable to mechanical damage, and hairs taken from a yarn show frequent abrasions and cracks—a fact commented on by Butterworth in 1881, and since apparently overlooked. Such abrasions are visible in dry cotton under quite a low magnification by reflected light as bright patches with an almost granular appearance, whilst cracks due to pressure can best be seen under a higher power if mounted in a suitable medium.



Notes to Plate:

I. Normal hair, × 500, showing convolutions and thickened edge.
II. Supernormallp thickened hair, showing absence of convolutions and small central canal, × 500.
III. Immature and thin walled hair.
IV. Cross sections: A, normal; B, supernormal thickening; C, thin walled; × 500.
V. Tips or tails of cotton hair, showing small diameter of hair and central canal. A, acuminate; B, spatulate. Drawn to same scale as preceding figures. Complete hairs drawn to this magnification would be 25 metres long.
VI. Typical appearance of hair under treatment with "cuprammonium," showing "beading" and bands of cuticle, also suggestion of "growth rings," × 200.
VII. Development of hair from seed coat. Day after opening of flower, × 350.
VIII. Ditto. Three days later.
IX. Pits in wall of hair (after Balls[67]).
X. Growth rings at tip of cotton hair (Balls[51]).
XI. Hair conformations, from data by Wiesner (38) schematic representation, length × 1·66, diameter × 430 from cross sections. A, *G. herbaceum;* B, *G. flavidum;* C, *G. conglomeratum.*

It is usually accepted that the cellulose composing the primary wall is chemically distinct from that of the secondary deposition. Whilst the exact relation of the cutinous substance to the wall is not known—whether, for instance, it is dispersed through its mass, or merely forms an external coating (which from the behaviour of the cuticle in cuprammonium seems likely)—there is evidence to prove a profound change in the chemical composition of the cell sap at the time when elongation in length ceases and secondary growth begins. The young hairs are extremely astringent, and possibly contain tannins, as they turn black when immersed in a solution of a ferric salt, whereas the ripe hairs do not. According to Bowman[44], in bad years this feature causes much trouble to dyers using iron salts. Again, bolls from the first stages placed in a fixing solution of acetic acid and alcohol " pickle " to a green colour, " which of course fades to brown on exposure to light. From the twenty-seventh to the forty-fifth day, however, the pickle thus made is at first pink and then bright red. When the boll is beginning to crack the pickle is brown." Balls[45] (1915), from whom this quotation is made, attributes the change to the development of pigment in the seed coat, but this in its turn is probably an index to more fundamental changes.

In connection with any discussion of the nature of the cuticle, there arises the question " Why, if the hair is developed inside a closed boll, dying as soon as it is opened, is there any need for a waterproof cuticle?"—or, even more generally, " What is the function of the cotton hair in the life history of the plant?"

The theory of the last century, accepted even by Haberlandt[46], that the lint is an adaption for wind dispersal, is no longer tenable. The seeds do not blow out of the boll singly, but in " locks " of half a dozen or more. The lint is so crumpled together that a single seed by itself would only be carried a few feet in a gale. Some wild forms have no lint at all, only a slight fuzz; others have lint only, while the majority have both lint and fuzz[47]. It has been suggested, *inter alia*, that the hair acts as a wet blanket to assist germination, but delinting by hand materially increases the percentage of germination, and seed cotton cannot compete with the same seed after ginning, though fuzzy seeds beat smooth seeds in the field, and primitive lint is little more than, or even the same as, fuzz.

The phylogeny of the Malvaceæ, to which *Gossypium* belongs, has not yet been construed into any explanation of the problem. *Thespesia* has minute seed hairs; *Bombax* and *Eriodendron* have their ovaries packed with down growing from the wall, not the seed coat. The opinion of the writer is that all these formations are adaptions of excess polysaccharides formed during the ripening of the seed, when nitrogen compounds are most needed, to protect the embryo against the phototoxic effect of intense insolation, in which the pigmented hairs of wild types would be a further help. At the same time, a strictly teleological explanation is not absolutely necessary. Such modifications tend to be perpetuated if they are of any use to the plant, but equally even if they are entirely neutral in character, or not actually disadvantageous.

(III.) *Secondary Thickening.* Crum[6], in his first paper of 1863, described a method of deposition in terms which would be acceptable to-day, but withdrew his hypothesis in the second paper as lacking confirmation, having no dated material. Since then there has been a general tendency to differentiate the wall substance into layers, in order to account for the fibrous appearance which is present in the broken ends of the hairs and particularly in material which has undergone mechanical disintegration, *e.g.*, cotton from filter paper[48]. The subject was complicated by the presence of spiral bands and striations in the hair.

Many text books, such as Matthews'[49], contain high power drawings of longitudinal sections in which an attempt has been made to give the streaked appearance of a specimen under magnifications of 1,000 and above, and various hypotheses, more or less plausible, have been made to explain them by the assumption of collapsed microcellular structure, spiral fibrillæ and the like. Bowman[50], after postulating a layer "formed by successive deposits of cellulose and coagulated protoplasm and other cell contents," was moved to complain that not even a magnification of 10,000 (*i.e.*, three times the maximum effective magnification possible with existing equipment) revealed any "constituent cells" in the wall. It was left to Balls[51] to settle the matter. In 1912, he had assumed, from data on the growth phenomena shown by the cotton plant from hour to hour in the field, that "concentric layers of cellulose, probably delimited from night to night, are laid down on the interior of the delicate cellulose cuticle wall, until a definite thickness is reached."

The theory of successive layers of wall was not a new one. Postulated originally to account for the apparent lamination of starch grains by Meyer[52] and Schimper[53], it had been used by Strasburger[54], Noll[55], Correns[56] and others to explain the wall formation of Algae, etc., and by the use of swelling reagents extended to many other types of cell.

Using a swelling reagent on cotton taken from dated bolls, Balls was able to prove definitely the presence of these rings up to the number of 25, with an average thickness of about 0·4 μ each, corresponding with the number of days from the cessation of growth in length, and accounted for their differentiation from each other by reference to the arrest of growth by the "Sunshine effect" occurring in the middle of each day in Egypt[57] (Fig. X.). The reagent used was 9% sodium hydroxide followed by carbon disulphide as used by Cross and Bevan[58] for the production of cellulose xanthate, but the rings have since been shown by several other solvents, such as cuprammonium and calcium thiocyanate, whilst the writer had made drawings of them before the publication of the paper, using 60% sulphuric acid (Fig. VI.).

It seems probable that a large number of observers have seen this appearance at one time and another without comprehending it, ascribing it, at most, to a diffraction effect, as in the case of Crum. Reference may also be made to figures made by Minajeff[59] showing half a dozen rings quite clearly.

It is not altogether clear how the demarcation of the rings is brought about. Whilst there is a definite periodic cessation of growth, this alone is insufficient to account for the rings. The analogy of growth rings in trees, formed by variation in the size of the wood vessels laid down in spring and autumn, does not help. So little is known of the colloidal structure of the cell wall that no colloidal parallel can be safely employed. It is noteworthy that unquestionable growth rings have never been described in the walls of untreated material, though well within the limits of resolution of the modern microscope. By Abbe's law, the number of lines per millimetre resoluble by a given objective is given by the formula

$$C = 2.L.N.A.$$

where L is the number of waves per mm. of the light used, and N.A. the numerical aperture of the lens.

Using blue light of 4500 A.U. and a Zeiss' "Apo." N.A.1·4,

$$C = 2 \times (1000/0{\cdot}4500) \times 1{\cdot}40 = 6200 \text{ approx.}$$

An average growth ring of 0·4 μ equals 2,500 lines to the mm. The lines in the diatom *Amphipleura pellucida* are given by Spitta as 1/100,000 inch apart, *i.e.*, 4,000 per mm. approx., and these are readily resoluble with a good objective and blue light.

Applying this formula to the question of Crum's rings, the difficulty arises that all that is known of his objective is that it was a 1/25″ Powell and Lealand. Taking the date into account, it is probable that it was a "water immersion" of N.A. about 1·00. He used lamp light, so assuming yellow light of 5,880 A.U.,

$$C = 2 \times (1000/0{\cdot}5880) \times 1{\cdot}00 = 3400 \text{ approx.}$$

and therefore it should have been possible for him to have seen growth rings of 0·4 μ thickness, the more so because the light would not be monochromatic. If, however, he used a *dry* objective of 1/25″, the N.A. would be insufficient to meet the case. It is curious that in swelling some hairs will show rings and others will not under precisely similar optical conditions. It would be interesting to know how rain-grown cotton compares with irrigation-grown in this respect. Little is known of the ultimate structure of the secondary deposition, and the units which various writers have claimed to see in disintegrated material are obviously of a very much greater magnitude than the giant molecules and micellæ of theory. From the behaviour of the wall in staining solutions there is ample reason for postulating a micellar structure (Haller)[60], whilst the spirally arranged fibrillæ of Kuhn[61] and Matthews[62] seem to depend on an incomplete knowledge of the laminated structure, and the spherical 1 μ granules of De Mosenthal[63] are postulated from precipitates from solutions.

(IV.) *The Central Canal.* The lumen of the cotton hair contains in a dead and desiccated state the remains of the protoplasm and the nucleus which were responsible for its growth. Whilst the lustre of the hair seems to be dependent on the cuticular surface and the convolutions, the colour is largely dependent on the contents of the canal, which on this account have received the label " endochrome," though this should strictly be confined to the colouring matter itself. Curiously pigmented forms, such as " Khaki," " Blue Bender " and " Texas Wool "—the last a bright green —occur from time to time, as well as many less brightly coloured " rogues," and many varieties have a strongly coloured fuzz.

In the developing cell the nucleus, as has been pointed out, remains near the growing apex. The whole of the lumen is of course covered with a layer of cytoplasm, whilst the centre of the canal is occupied by vacuoles containing cell sap, which by its osmotic strength keeps the hair in a condition of turgor.

Nothing is known of the behaviour of this protoplasm as regards the circulation, rotation and other streaming movements which Ewart[64] has shown to exist in most cells, and which are important when the spiral structures of the wall are under consideration. There is no record of any extra-nucleolar structures in the cytoplasm, which, if present, would exercise a profound effect on the wall growth; nor is anything known of the biochemistry of the hair, of the cell sap from which the cellulose is built up, or the enzymes which are the agents of the protoplasm in this transformation. This lack of information is by no means confined to the cotton hair, but extends to the plant metabolism. Little, for instance, is known of the significance of the glands with which the whole plant is studded from its embryonic state, and which must play some role of importance in its interior economy.

Several writers have spoken of the withdrawal or resorption of the protoplasm when the hair is ripe, but it appears from Balls' work that all that occurs is that the hair dies rapidly by desiccation when the boll opens.[65] In view of the increasing osmotic strength of the cell sap, as the hair dries, such resorption is even an impossibility.

The presence in the hair of protein remains of dead cell contents is a feature of some importance in the various manufacturing processes, though it is to be expected that considerable variation will occur in different cottons, whilst even in two samples of cotton from the same area exact chemical analysis should show slight differences in their nitrogen content. Two of the most important constituents of the hair from the manufacturer's standpoint are the wax and oil globules, though information is lacking as regards their distribution in the structure. It is generally taken that the wax forms part of the cuticle, and the oil is commonly but erroneously stated to be an " escape " from the seed, though probably the latter is present also in the living cell.

The central canal, by reason of its nitrogenous content, forms a suitable medium for the growth of bacteria, and evidence of bacterial invasion at damaged portions is frequent. For the relation of cotton to bacterial growth, reference may be made to the papers of Fleming and Thaysen.[66]

(V.) *Pits.* Perhaps most controversial of all the points in connection with the hair structure, and at the same time the most important in dyeing and other processes, is the question of openings in the wall. Cracks, running more or less spirally along the cuticle, have been seen by several observers, and can be produced at will by mechanical ill-treatment of the hair. Definite pores in the cuticle have, however, been observed by Mosenthal[63]. These pits or pores, to which he gave the unfortunate name of *Stomata*, are described by him as occurring in oblique rows as if they led into oblique lateral channels . . . "many of the corrugations, striations and indentations which the microscope reveals in the cotton fibre can, with proper preparation of the slides and with high magnification, be resolved into pores and oblique rows of stomata. . . . In fragments of cuticle obtained from solutions in cuprammonium the pores and stomata can be seen." In his photograph these pores are fairly clearly shown, though the structures labelled in the figure of cuticle from cuprammonium are rather dubious, being elongated slits more like cracks than pores.

It is difficult to reconcile these pits with the known structures of plant morphology (though reference will be made to the subject below) nor are they to be confused with the pits described by Balls[69] in growing hairs. These pits are shown as oblique, slit-shaped cracks in the secondary thickening, tapering from the centre of the hair toward the outside, and not passing through the outside. They are claimed by Balls to be responsible for the convolutions of the hair, but their mode of formation is not suggested. The pits become visible in the third day of the secondary thickening, and are obliterated by the twisting of the ripe material.[68] (See Fig. IX.)

Confirmation and explanation of the presence of these pits is needed. Do the pores occur on the cuticle outside them, and through what agency? If the pits did not appear until the secondary thickening was complete, it would be more easy to explain them, but, occurring so early in the development, their shape is an anomaly. They cannot be considered as true pits in the botanical sense, for they would in that case tend to be wider at the outer wall and narrower at the inside.

(VI.) *Spiral Markings and Striations.* Spirals and striations on the cell wall of cotton have been mentioned by numerous writers from Butterworth[4] onwards, and more than one observer has been tempted by this evidence (Kuhn[61], Matthews[62]). It should be pointed out that striations and spirals in the wall are by no means confined to cotton hairs, but occur in a large variety of vegetable cells, such as wood tracheides, the elongated bast cells which form the raw material of such textile materials as flax and hemp (Höhnel[69]), and even cells of *Ornithogalum* and *Hyacinthus* (Correns[70]), whilst their nature has been discussed by Strasburger[71].

At the same time mention must be made of the spirals which are visible when the cell wall is destroyed by swelling with cuprammonium or other solvents. The general appearance of cotton under this treatment is widely figured and well known. The secondary thickening layers of the wall swell up rapidly, assuming an amyloid condition, and burst the cuticle which is less affected. Part of the cuticle remains in the form of spiral and annular constrictions which cause the typical beaded appearance of the swollen hair, while the remainder sloughs off in fragments which usually twist up by reason of the irregular tensions acting on them. Portions prevented from twisting frequently show traces of a spiral striation. At the same time the central canal takes on a distinctly twisted and spiral shape. For figures of these appearances in all stages reference may be made to the work of Minajeff[43] and the excellent microphotography of Herzog[72]. In the absence of more exact knowledge of the structure of the hair and in particular the position and number of these spirals in untreated material it is manifestly unsafe to discuss their bearing on the mechanical properties and the convolutions of the hair. It should be remembered that the vigorous nature of the treatment, and the twisting that takes place under it, are particularly likely to cause artifacts and to suggest structures which are not naturally present. With critical microscopy it is possible to see many of these features in raw material or material which has been treated with reagents which do not cause any profound chemical or physical change in the hair.

(VII.) *Convolutions.* The cause and the nature of the convolutions in cotton are still to seek, though several theories have been put forward. Bowman[73] gives the number of convolutions as varying between 150 per inch for Indian cotton to 300 for Sea Island, while Hanausek[74] considered that the commercial value of a cotton was proportional to the number of twists and their regularity. The lack of uniformity in the direction of convolution is strikingly shown in a diagram given by Scott Taggart after Gribble.[75]

Balls suggests that the twists are due to the presence of the pits which he described. Kuhn gives an involved hypothesis depending on his assumption of a wall composed of spiral fibrillæ, whilst the several writers content themselves with " the mystic gyrations of the protoplasm in the dying cell."

Scott Taggart's opinion, that the convolutions are dependent on some form of spiral inequality of the wall, is at present the most warrantable theory and compatible with Balls' more specific attempt at explanation; but it still remains to be proved to what extent such inequality is present, and how far the twist is predetermined or influenced by environmental factors.

(VIII.) *Abnormalities.* In the course of microscopic examination of sufficiently large numbers of hairs, abnormalities are found to occur. Of these, such oddities as branched and septate hairs are rare, and have only been figured by Morris and Wilkinson[77]. " Bulges " or " blisters " are sometimes seen, and require explanation, as do the adherent patches of brown matter described by Vetillart[10]. By far the commonest abnormality is " Dead Cotton," *i.e.*, cotton which has been picked before it has completely matured. The hairs in this case have very thin walls, due to incomplete deposition of secondary thickening, and are deficient also as regards convolutions, being crumpled rather than twisted. The classical treatise on this occurrence is that of Crum[6], but almost every writer on cotton has considered it. According to Kuhn[61] a greater proportion of such hairs occurs in the coarser varieties than in the finer. Haller[43] remarks on a chemical difference between the unripe and the mature fibres, which is in accordance with the observation of Bowman quoted above[44] on the trouble caused to dyers, and with the remarks of Balls on the change which takes place with the beginning of the secondary deposition[45]. " Dead " cotton is very prone to give rise to " neps," but these are formed in ginning and subsequent processes, and do not occur in cotton in the natural state.

The use of the adjective " dead " is unsatisfactory, since all the cotton used in spinning is dead. " Unripe " or " Immature " would be better words for the condition, preferably the latter. The converse to " unripe " cotton is the " over-ripe." In this case, the secondary thickening is unusually developed, giving a stiff, straight hair, with little flattening or convolution. Both forms occur in otherwise normal seeds, owing to the fact that the hairs on an ovule are all distinct individuals and do not thicken their walls to the same degree, while all the ovules in a boll do not ripen simultaneously. Much of the immature cotton of commerce is due to the bad practice of taking cotton from unripened bolls, particularly at the end of the season. Further reference may be made to a recent paper by Herzog[77] distinguishing between " Dead " and " Immature " cotton, in which he agrees with Haller[78] (Beiträge zur Kenntnis der toten Baumwolle).

It is time that a definite agreement was made on the use of adjectives describing these conditions. For all practical purposes, " immature " could safely be used for cotton in which the weakness is due to the incomplete ripening of the boll, and " thin walled " for cotton in which the condition is localised and dependent on the individuality of the hairs, other hairs on the same seed having *normal* or *supernormal* thickening. (See Figs. I.—IV.)

THE LITERATURE OF CELL WALLS.

Theories and opinions as to the structure of the cotton hair are so dependent on the more botanical theories of the nature of the cell wall that a brief outline of the subject is necessary.

Following on the establishment of the cellular structure of plants, Von Mohl[79] was the first to insist on the position of protoplasm as the essential vital constituent of the cell, defining the nature of the wall as a secretion of the protoplast. Nägeli's[80] theory of intussusception held the field for some time with the assumption that cell walls grow in thickness by the deposition of new particles in the interior of the existing membrane, where they became incorporated in the micellar framework of the wall under the influence of forces inherent therein. Hofmeister[81], on the other hand, held that the membrane was not a dead end-product of metabolism, but alive and endowed with all the characters usually ascribed to protoplasm. The catholic application of intussusception was displaced by the theory of apposition, or growth by the superposition of entire lamellæ of new material, following conclusive proofs of a number of cases by Schmitz[82], Noll[55] Krabbe[83], and others.

The discovery of other examples where this process could not take place led to a revival of the belief in the vitality of the wall (Wiesner[84], Strasburger[85], Askenasy[86]), though it has been pointed out by Correns[56] that the hypothetical plasma in the wall has never been demonstrated. His experiments on *Gloeocapsa* (1891) proved that cases exist which can only be explained by intussusception, and, at the present day, as far as growth in thickness is concerned, a balance must be held between both theories pending further discoveries. As regards the " vital " theory of Hofmeister, it is interesting to note that Balls (1919) has observed abnormal appearances which he takes to indicate that growth may take place in the wall for a time without its being in full contact with the ectoplasm.

Townshend[87] has shown that the protoplasm can build a membrane only when it is provided with a nucleus, or when connected by protoplasmic strands with cytoplasm containing a nucleus; though Jost[88] states that a nucleus without protoplasm is incapable of forming a cell wall. Haberlandt[89] has pointed out that the nucleus frequently approaches the region of the wall which is actively growing. In hairs which grow basally, the nucleus remains near the base. In hairs which grow apically, as in cotton, it remains near the tip.

Growth in length of a cell, or growth in surface of its wall, is difficult to explain except in terms of stretching and intusseception, though Schmitz[82] and Strasburger[54] have observed at the growing apex of *Bornetia secundiflora* a kind of lamination and successive overlapping of layers of growth. The figure bears a superficial resemblance to Balls' drawing of a cotton hair tip showing growth rings[51], though the two are of course not analogous, the cotton being secondary thickening. The researches of Noll[55] on *Derbesia*, *Caulerpa*, etc., prove that deposition of such lamellæ does take place at the growing tip, which continually bursts through the older layers. The exact nature of the growing point of the cotton hair is obviously a matter for elucidation.

Many investigators have tried to demonstrate the presence of an organisation in the cell wall more minute than striations and lamellæ. Nägeli[80] believed that the wall was composed of extremely minute fibrils, which in their turn were composed of the ultimate particles of the wall, the micellæ, and it is no doubt on a misconception of his theory that such writers on cotton as Kuhn[61], Matthews [62] and Mosenthal[63] have based their ideas. More recently, Wiesner[90] (1892, etc.) devised a theory of " dermatosomes," under the influence of vitalism, and even succeeded by a special method of digestion in breaking the wall into a dust-like powder to which he applied the name; but as in the case of cotton treated with cuprammonium the results are extremely dubious and may be " artifacts."

The stratification of walls has received much attention. Nägeli held that optical differences were due to varying water content in successive layers, though Correns[55] has shown that whilst bast fibres, etc., have the appearance of rings when thoroughly dried, such material as the pith cells of *Podocarpus* is not affected, and that in such cases a chemical or physico-chemical difference must be postulated. Similarly with striations : when only one set are visible these are taken to be on one layer of the wall, and when intersecting series are visible, on two or more layers. Correns has shown that these may be due to differences in water content, chemical differences, or a combination of both. For the striations of the epidermal walls of *Hyacinthus* and *Ornithogalum* and the oblique striation of fibres, the former is responsible, and Krieg[91] has shown that the striation of coniferous tracheids is dependent on different water content of various layers. No cases due to purely chemical differentiation have yet been proved, though recently Forest Brown[92] has demonstrated a chemical " skeleton " in tracheids.

There is still a lacuna in our knowledge of the formation of spiral, annular and reticulate thickening of Xylem vessels, though the work of Rothert[93] may be consulted. Fairly complete reviews of the literature of cell wall structure may be found in Gaucher[94].

GENERAL CONSIDERATIONS.

The most singular feature of the cotton hair is the ratio of its length to its breadth, which may rise, in a good Sea Island type, as high as 1 :4000 (*i.e.*, in a hair 50 mm. long × 15 μ diam.). According to Haberlandt, even this is exceeded by bast cells of certain *Urticaceæ*, which may reach a length of 200 mm.[95] The ratio for flax is given by Vetillart[11] as 1 :1200. Apart from this, there is little in the cotton hair that does not find its parallel elsewhere in plant anatomy. It is true that the pits in the hair wall are not to be found elsewhere in epidermal cells, but pores are known to exist in the trichome hydathodes of *Stictocardia* and *Operculina* in the *Convolvulaceæ*, and in the flying hairs of *Dryas* and *Anemone pulsatilla*, if these are comparable. There is no explanation at present available to account for the mode of formation of the pits, if they are definitely formed in growth and not by contraction.

After the pits, the most puzzling features of the hair are the striations and the spirals in the wall, which, in view of their probable relation to the convolutions, raise the whole question of the predetermination of conformation. The work of Church[95] on phyllotaxis, and Ewart[64] on the streaming of protoplasm, contains much that with increased knowledge of the cell during growth could be directly applied to its elucidation. As things stand, there is direct inducement to connect the spiral path of the nucleus and the cytoplasm, with its frequent reversals, with the localised thickenings of the wall layers which produce the " spirals " and striations (in particular, the pronounced spiral so often seen on the cuticle might well be this), and the spirals in their turn with the convolutions which occur when the hair dries up. If Balls' account[29] of the nucleus remaining close to the tip during the formation of the secondary layers is correct, difficulties appear, but are not insurmountable. Further, the erratic behaviour of the nucleus must be influenced by daily and environmental changes, as is the turgor of the cell. It is very probable that careful exploration of single hairs of known history would reveal traces of these influences.

With the question of function, other problems, as for instance the biochemistry of the plant and the presence of its resinous substances, are bound up, and invite solution. In this connection, the rather subversive attitude of Church[97] in regarding cell walls as the relics of an excretory process in the primitive unicellular organisms of the sea is not uninspiring. In the first forms of life on the earth, the free swimming auto-trophic plancton, there was no cell wall. In the course of manufacture of food substance by means little differing from those of the later terrestrial vegetation, inutilisable polysaccharides were produced which were excreted centrifugally, forming a protective covering whose manifold utility led to its permanent retention. Such polysaccharide debris, unlike the other end-products of metabolism, cannot be resorbed, although of the greatest use to the organism architecturally.

From this point of view it is reasonable to suggest that the hairs of the cotton seed may possibly afford a useful outlet for the elimination of excess polysaccharide from its metabolism at a time when its needs are chiefly proteins for the developing seeds.

The function of the hair, once formed, must remain a matter of question —if any explanation is needed, the modern tendency being towards distrust of teleologisms. With the possible exception of the pits, and the unusual length/diameter ratio of the hair, there seem to be no botanical abnormalities about cotton; in fact, it serves to throw useful light on other cells and their walls, and by reason of the diversity of its structures almost forms a connecting link between the simple cell walls of epidermal layers and the elaborate configuration of xylem vessels. There is still room for a very large amount of work where these structures are concerned.

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THE HEAT DEVELOPED BY THE ACTION OF CAUSTIC SODA ON COTTON ("MERCERISATION").

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I.—INTRODUCTION AND OBJECTS OF EXPERIMENT.

When cellulose in the form of cotton is treated with an aqueous solution of caustic soda in the process known as "mercerisation," the twisted, ribbon-like fibres absorb a certain amount of the liquid and swell out to a more or less circular section, the amount of swelling depending on the strength of the NaOH solution. The swollen fibre is said to be "mercerised." The degree of mercerisation produced has been measured in various ways, all of which appear to give different results. The mass or the volume of NaOH solution absorbed by a given mass of cotton; the contraction in length of cotton yarn; the amount of dye taken up by the yarn after mercerisation; the lustre produced: these have all in turn been taken as a measure of the degree of mercerisation. Curves are given in Section 5, showing the connection between "Strength of NaOH solution" and "'Degree of mercerisation" as measured by some of these different methods. (See Curves in Figs. 7 and 8.)

Shrinkage, lustre, and dyeing effects in yarns and fabrics are, however, complicated by the fact that they may depend not only on the degree of mercerisation of the individual fibres, but also on the relative positions of the fibres in the yarns. A safer comparison of the effects of different solutions could be carried out by measuring the changes in length, volume, or section of fibres. So far as this has been done, it appears that the results are different according to which physical change is taken as a measure of the mercerisation. This is no doubt due to the variation of the properties of the fibres in different directions.

In the experiments now to be described, *the heat developed in the reaction* has been measured. The object was to determine the connection between "Heat of Mercerisation" and the "Strength of the Solution." The results are exhibited in Fig. 6.

A few experiments have already been published by various authors on the "Heat of Swelling" of cellulose in various liquids. Vignon (Comp. Rend., 110, pp. 909-910, 1890) for example, employing an ordinary calorimetric method, found that 6·5 calories were evolved on adding 1 gram of unbleached cotton thread, with full moisture content, to a normal solution of NaOH. Rosenbohm (Koll. chemische Beihefte, 6, pp. 177-200, 1914), used an ice-calorimeter and obtained a result of 9·6 calories per gram of cellulose (completely dried filter-paper) in pure water. For dried cotton waste the result was 20·8 calories.

All these investigations, however, were concerned with the heat produced by a liquid of given concentration on various solids, including cellulose. The present paper, on the other hand, deals with the action of solutions of various strengths of NaOH on one solid, viz., cellulose in the form of cotton fibres.

II.—MATERIALS USED.

The cotton used throughout the experiments was "Egyptian Sliver" which had been "kiered" for five hours under a pressure of 20lbs. per square inch in 1% caustic soda solution, well washed and allowed to dry. Great care was taken in the maintenance and measurement of the moisture content of the cotton. It was kept for several months in a desiccator over dilute H_2SO_4 of fixed concentration (Sp. Gr. 1·345), and maintained at nearly constant temperature. Two samples were weighed at intervals of a few days during all this time, and after about a week their weight remained practically constant. The moisture content, as determined by weighing 5 grams of it before and after heating at 105°C for five hours, was found to be 5·1 per cent. of the weight of the cotton.

The caustic soda solutions were prepared from sticks of the purest obtainable material, and the percentage content of NaOH in each solution was very carefully determined for us by Miss G. M. Wigley, B.Sc. (Tech.) by titrating against HCl using phenol phthalein as the indicator.

III.—APPARATUS.

Most instruments employed in the determination of quantity of heat depend on exact measurement of temperature. The measurements therefore involve the use of a thermometer of some kind, with its accompaniment of numerous adjustments, corrections, and calculations. If the amount of heat to be measured is small (as in the present instance where the greatest temperature rise was only 0·5°C) or is evolved slowly, the corrections to be applied to the thermometric measurements become increasingly important and difficult to determine with any degree of accuracy.

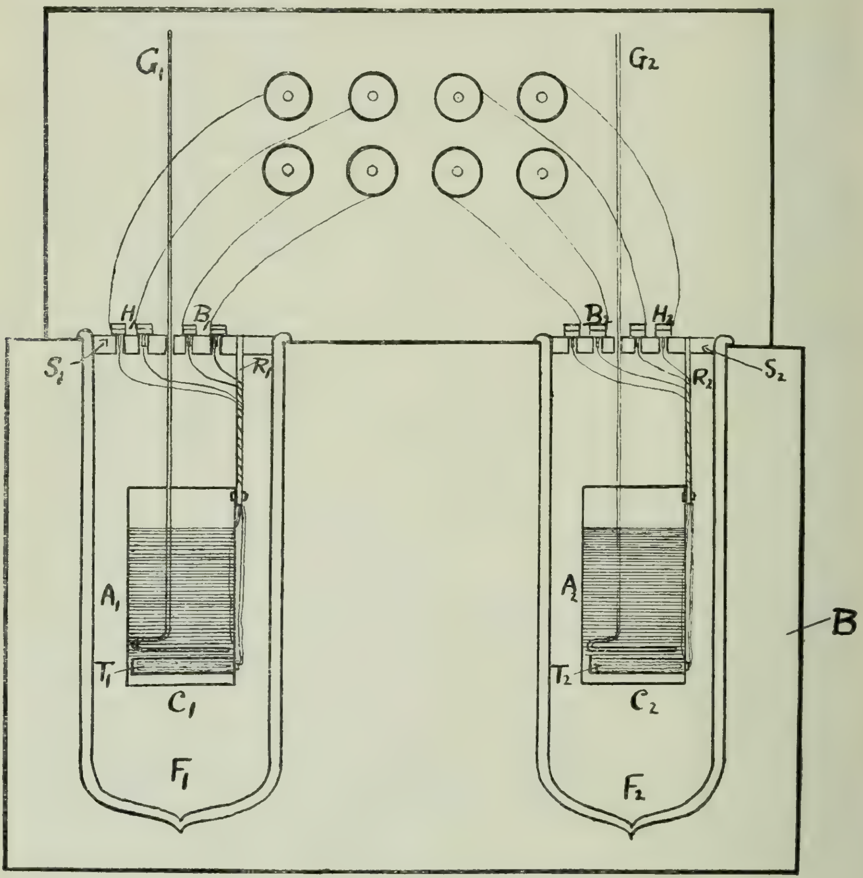

FIG. 1. Apparatus employed in heat measurements.

For this reason, the apparatus to be described was designed for the direct measurement of heat without measurement of temperature, though the temperature may, if required, be easily deduced. Small quantities of heat, even if evolved slowly, can with its aid be accurately measured. The measurement is independent of the specific heat of the liquid employed and of the total thermal capacity of the calorimeter and its contents. Heats of solution and dilution, specific heats, water equivalents, and similar quantities can be easily and rapidly measured with its help.

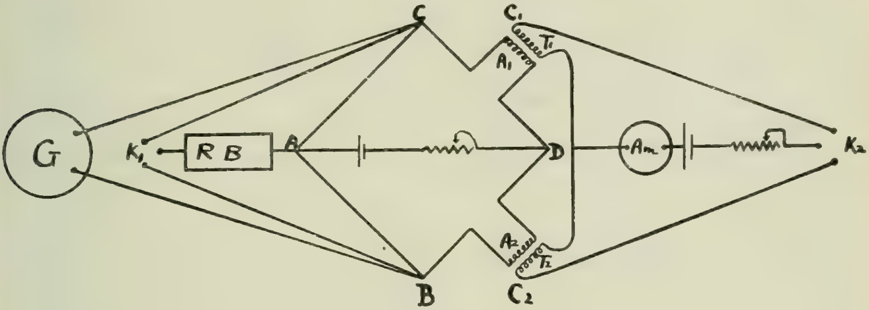

FIG. 2. Arrangement of Apparatus.

Two spun copper calorimeters, C_1, C_2 (Figs. 1 and 2) as nearly as possible identical in dimensions and weight, were employed, each of diameter 2·5 cms, height 5 cms, and weight 12·0 grams. Around the middle of each were wound 80 turns of thin cotton-covered copper wire, S.W.G. No. 47, of resistance 9·95 ohms at 20°C (A_1, A_2). Copper tubes T_1, and T_2, with their inner ends closed were soldered into the calorimeter near the bottom. Each tube contained a "heating coil" of silk-covered eureka wire, S.W.G. No. 34, resistance 8·81 ohms. This value was checked from time to time. A measureable amount of heat could thus be given electrically to each calorimeter. Copper leads of gauge 30 S.W.G. connected these coils and also A_1, A_2 to terminals H_1, H_2, and B_1, B_2, respectively. Two rods R_1, R_2 of thin ebonite attached to the calorimeters and to cork stoppers S_1, S_2 served to keep the calorimeters in position within two Dewar vessels F_1, F_2.

The Dewar Flasks rested side by side in sawdust in a wooden box B. Two stirrers G_1, G_2 made of thin glass tubing closed at the ends were employed to keep the liquids in circulation during an experiment.

The copper coils A_1, A_2 (see Fig. 2) formed two adjacent arms of a Wheatstone Bridge arrangement, the other two arms AC and AB being two nearly equal 10-ohm coils of eureka kept in one bath of oil. A resistance box RB could be shunted over either of the arms AC, AB, in order to restore balance when necessary. A carefully calibrated Siemens and Halske ammeter Am with open scale indicated the current through either of the "heating coils" T_1, T_2. The coils had a negligibly small temperature co-efficient ($-0·000026$) within the range of temperature employed. The calorimeters, wires, and heating tubes being all of copper ensured rapid distribution of heat throughout, so that a steady state of temperature was reached in a very short time. Difficulties due to uncertain lag were thus obviated. Another advantage of the arrangement, due to the thermal equality of the two calorimeters, is that any alteration of outside temperature produces the same effect in both. As a result of this thermal equality a moderately large current could be employed if required to "run" the

Wheatstone Bridge, as both of the coils A_1, A_2, would be equally affected. This was verified several times. Either calorimeter could of course be used for the heat measurements, and one served as a check on the other.

IV.—METHOD OF MEASUREMENT.

In a determination of the heat produced by the addition of cellulose (cotton fibres) to a caustic soda solution, the method finally adopted was as follows:—

Equal masses of NaOH solution (usually about 12 c.c.) were placed in each calorimeter and allowed to stand until temperature conditions were steady. The " bridge " was adjusted with the help of the resistance box RB, to give no deflection of the galvanometer. A weighed amount (about 0·25 gm) of cotton was then placed in one of the calorimeters (say C_1). The galvanometer was deflected owing to the increase in temperature of the copper coil A_1, caused by the evolution of heat when the NaOH and the cotton came into contact. Readings of the deflection were taken every minute or half minute, until it was judged that no further heat was being given out. The deflection was then reduced to zero by heating electrically the other calorimeter C_2. A current C was now sent through the heating coil (of resistance R) of the calorimeter containing the cotton, for *t* seconds, so as to produce as nearly as possible the same deflection as before. Readings of the deflection were again taken every minute for 10 to 30 minutes. In most cases this part of the experiment was done two or three times. The heat produced is then C^2 R.T. ÷ 4·19 calories. Readings of the deflection as the temperature was falling indicated the rate of loss of heat by radiation, conduction along the leads, etc. These readings were then applied as a correction to the actual deflections in a manner analogous to Regnault's method in calorimetry, in order to obtain the true deflections, i.e., the maximum deflections that would have been observed had there been no external loss of heat. (See Figs. 4 and 5, and Section 4.)

In general, the two maximum deflections were not exactly equal, and a small correction had to be made on the assumption that the quantities of heat given in the two cases were proportional to the deflections. This was verified many times experimentally. Experience enabled one to judge when to switch off the heating current, which was adjusted so as to produce heat at approximately the same rate as when the cotton was added to the caustic soda solution.

In this way the total quantity of heat given is measured even if evolved slowly. The shape of the Curve (See Fig. 3) gives an indication of the rate of evolution of heat.

The galvanometer employed was a low-resistance Gambrell, with very steady zero, and of sensitivity about 10·7 amp. per scale division at a distance of one metre. Readings of the deflection could easily be read to half a division, i.e., to about a quarter to a half of one per cent. in most cases.

V.—EXPERIMENTAL RESULTS AND DISCUSSION.

The method adopted in measuring the amount of heat produced by the addition of a given mass of cotton to a particular concentration (55%* of NaOH) is illustrated by the four curves A, B, C, D in Figs. 4 and 5. A description of the method has been given in Section 4.

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* " Concentrations " are given as " Grams of NaOH in 100 c. cms. of solution." Conversion to " Grams of NaOH per 100 grams of solution," and to density of solution in " Degrees Twaddell " is given at the end of the paper. (See Addendum.)

Curve A gives the actual deflections of the galvanometer when 0·2490 gms. of cotton were added to 16·93 gms. of NaOH solution of concentration 55% (gms. per 100 c.c.).

Curve B is obtained from A by adding corrections from the "curve of cooling" (latter part of Curve A).

Curve C represents deflections at each minute when a current of 0·1624 amp. was sent through the resistance 8·81 ohms of "heater" T_1 for 175·5 seconds.

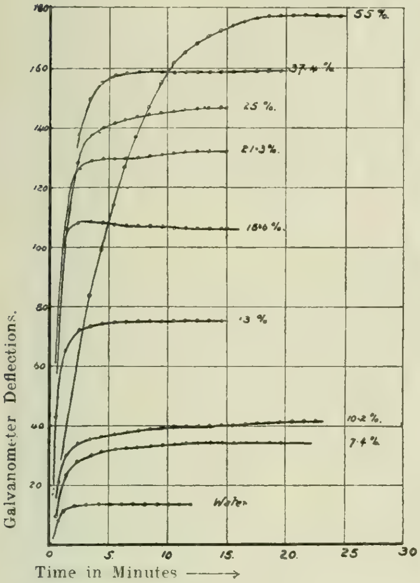

FIG. 3. Corrected Galvanometer deflections at each minute after adding cotton to NaOH solutions of various strengths (gms. per 100cc.).

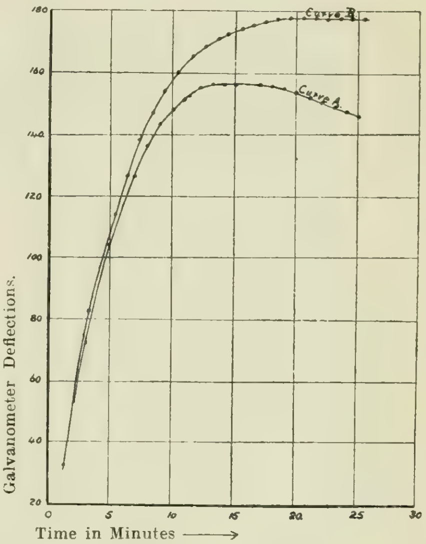

FIG. 4. Deflections (Curve A) and corrected deflections (Curve B) of Galvanometer when cotton was added to NaOH 55% (gms. per 100ccs.).

Curve D is obtained by adding corrections to C from the curve of cooling (latter part of Curve C).

It is seen from the curves that the true maximum deflections are 177·4 for the cotton, and 176·3 for the heater.

The heat evolved in calories by 1 gram of cotton is therefore

$$\frac{(0\cdot1624)^2\times8\cdot81\times175\cdot5}{0\cdot2490\times4\cdot19}\times\frac{177\cdot4}{176\cdot3}=39\cdot2 \text{ Calories.}$$

In a similar way the following results were obtained:—

TABLE 1.

Sp. Gr. of NaOH Solution	0	1·077	1·108	1·130	1·178	1·200	1·229	1·242	1·270	1·318	1·420
Grams of NaOH in 100 c.cms. of Solution	0	7·4	10·2	13·0	18·6	21·3	25·0	27·0	30·6	37·4	55·0
Calories per gram of Cotton	3·6	6·7	9·3	16·1	22·5	25·9	29·5	31·4	33·8	36·7	39·2

These results are shown graphically in Fig. 6.

The effective water equivalent of the calorimeter C_1 was determined as follows:—

10 gms. of water at temperature about 19°C were placed in each calorimeter, and a current 0·1586 amp. sent through coil T_1 (8·81 ohms) for 100

seconds. The corrected deflection was found to be 117·7 divs. Another 5 gms. of water being added to each calorimeter, a current of 0·1580 amp. for 132·5 seconds produced a true deflection of 112·0 divs.

Let X denote the water equivalent of the calorimeter: H_1 and H_2 the amounts of heat given to the calorimeter in the two cases.

θ_1 and θ_2 the respective galvanometer deflections (which are proportional to the rise in temperature of the calorimeter).

Then it is clear that

$$\frac{(10+X)\theta_1}{(15+X)\theta_2}=\frac{H_1}{H_2} \text{ or } X=\frac{15\theta_2\ H_1-10\ \theta_1 H_2}{\theta_1\ H_2-\theta_2\ H_1}$$

Employing this equation, the effective water equivalent was found to be 3·35 grams.

The increase in temperature of the calorimeter in any given case, e.g., when cotton is added to a caustic soda solution, can now be easily calculated when the specific heats and masses of the contents are known. In the example given in the first part of this section, on adding 0·249 gm. of cotton to 16·93 gms. of NaOH of Sp. Gr. 1·42 the rise of temperature may be calculated to be about 0·5°C and this was the greatest temperature increase dealt with.

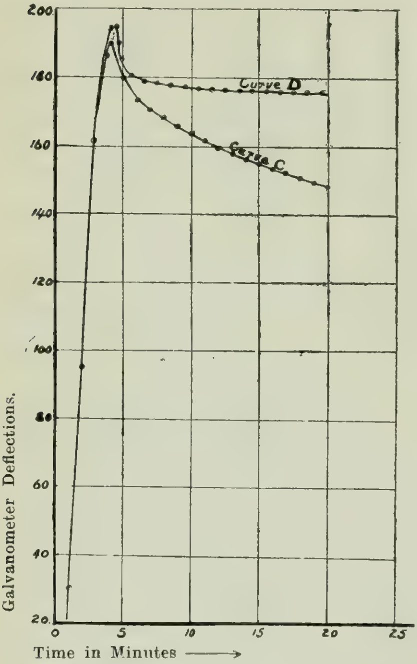

FIG. 5. Deflections (Curve C) and corrected deflections (Curve D) of Galvanometer when the Calorimeter C_1 was heated electrically for 175.5 secs.

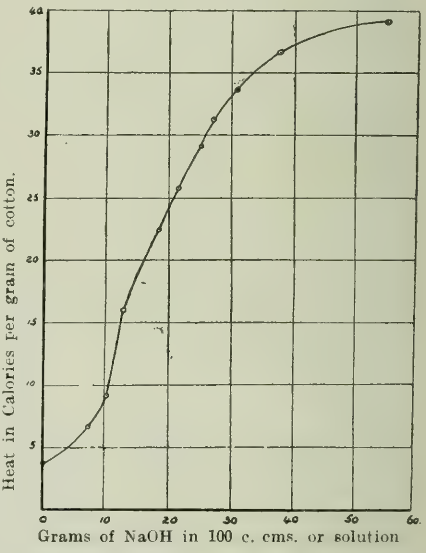

FIG. 6. Degree of mercerisation of cotton as measured by the heat produced. (See table I).

A small correction to the figures in Table 1 is necessary on account of the heat produced by dilution of the NaOH solution by the water content (5·1%) of the cotton. The amount of heat thus produced can be approximately obtained from results by Thomsen (Thermo. Chem. Unters. **3,** 84) and by Richards & Rowe (Jour. Amer. Chem. Soc. **43,** 4, Apr. 1921).

The heat produced by this dilution is greatest at highest concentrations of the NaOH solution. It becomes less and less as the strength of the solution decreases and eventually changes sign. In no case, however, is the correction greater than 1%. (Results published of "Heats of Dilution" all appear to deal only with cases where comparatively large quantities of water are added to the solution. As the measured quantities are varying throughout with the strength of the solution, and even changing sign at one point, the results given are useless for many purposes. The apparatus employed in the present research is eminently suitable for measuring heats of dilution at any point of the scale of dilution, and it is proposed in the near future to obtain a complete curve of heats of dilution in the case of caustic soda.)

The main conclusions of the present paper are shown in Table I, and Figs. 3 and 6, which indicate that the "heat of mercerisation" of cotton by NaOH solutions increases with the strength of the solution, but is not proportional to it. There are two inflections in the curve. The first is between 10% and 15% NaOH,* indicating a rapid increase in the heat produced in that region. It is well known to textile workers that it is at this point that true mercerisation as shown by swelling in section of the fibres or by contraction in their length begins. The other inflection is at about 30% NaOH which is near the upper limit of solutions ordinarily employed in mercerisation.

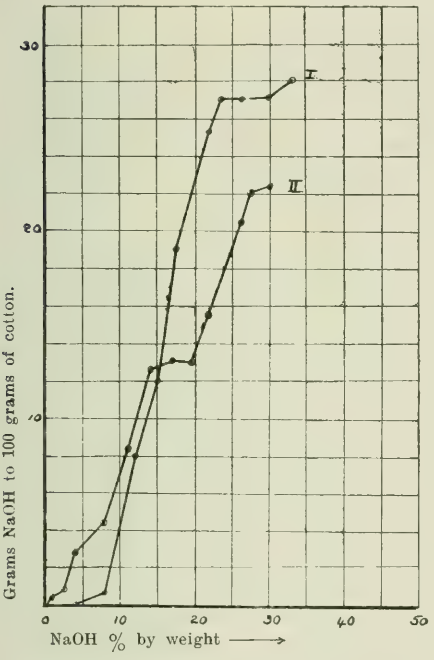

FIG. 7. Degree of mercerisation as given by mass of NaOH solution taken up by a given mass of cotton.
I. Leighton (J. Phys. Chem. 20, 32-50, 1916).
II. Vieweg (Ber. 40, 3876, 1907).

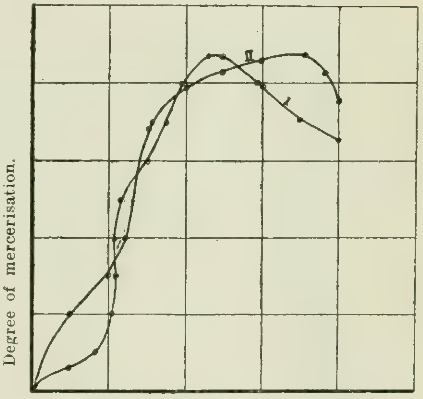

FIG. 8. Degree of mercerisation as measured by
I. Shrinkage in length of cotton yarn.
II. Affinity for Dyes.
(Hübner & Pope. J.S.C.I., p.404, 1904).

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* *i.e.*, 10 to 15 gms. NaOH per 100 c.c. of solution.

The Curves shown in Fig. 3 give an indication of the rate at which heat is evolved by the addition of cotton to NaOH solutions of various strengths. With densities below 1·20 and above 1·125 it appears that all, or nearly all the heat is given up in the first two minutes, but outside these limits the time required is greater. For example, with a solution of strength 55% the curve only becomes horizontal (indicating that all the heat has been evolved) in about 20 minutes.

Figs. 7 and 8 give an interesting comparison between the Curve obtained in these experiments (Fig. 6) and those given by various experimenters connecting "Strength of NaOH Solution" and "Degree of Mercerisation" as measured by

(1) Mass of NaOH solution taken up by cotton (Fig. 7).
(2) Shrinkage in length of cotton yarn (Fig. 8).
(3) Affinity for dyes (Fig. 8).

Curve 1 in Fig. 7 is taken from a paper by Leighton (J. Phys. Chem. **20,** 32-50, 1916).

Curve 2 in the same Figure was given by Vieweg (Ber. **40,** 3876, 1907).

The two curves of Fig. 8 were published in 1904 by Huebner and Pope (Jl.S.C.I., p.404, 1904).

The experiments described in this paper were carried out in the Physical Laboratories of Victoria University, Manchester, and our thanks are due to Professor W. L. Bragg for kindly placing the resources of the laboratories at our disposal. We are also deeply grateful for the helpful advice of Dr. R. S. Willows, of the Tootal Broadhurst Lee Co., Ltd., laboratories, where some of the preparatory work was carried out.

Addendum: Concentrations of Caustic Soda Solutions employed in the above experiments have been given as "Grams. of NaOH in 100 cub. cms. of solution" (See Table I and Figs. 3 and 6). For convenience of reference, these have been converted to "Grams of NaOH in 100 grams of solution," "Specific Gravity of Solution," and "Density expressed in Degrees Twaddell" in the table below:—

Gms. NaOH per 100 c.c. of solution.	Grams NaOH per 100 gms. of solution.	Specific Gravity.	Degrees Twaddell.
7·4	6·9	1·078	15.6
10·2	9·2	1.105	21·0
13.0	11·6	1·130	26·0
18·6	15·8	1·178	35·6
21·3	17·8	1·1995	39·9
25·0	20·4	1·228	45·6
27·0	21·7	1·243	48·6
30·6	24·1	1·2695	53·9
37·4	28·4	1·316	63·2
55·0	38·7	1·4205	84·1

THE DETECTION AND ESTIMATION OF ACIDITY AND ALKALINITY IN COTTON FABRICS.

By Hubert Frank Coward and Gladys Mary Wigley.
(The Tootal Broadhurst Lee Co., Ltd., Research Department).

Although the injurious effects of traces of strong acids on the cotton fibre have long been recognised, we are unable to discover any account of experiments which establish the accuracy of a quantitative test, or the sensitivity of a qualitative test, for acid in fabric.

Until recently, it was regarded as satisfactory to titrate the acid by decinormal or weaker caustic soda, the cloth being suspended in a suitable volume of water. No reference is made to certain necessary precautions, and no experiments have been made to check the accuracy of the method by the use of fabric containing known amounts of acid. For merely qualitative recognition of acid, litmus paper and litmus silk have been used—pressed against a moistened sample of fabric, or moistened with a concentrated extract of the fabric; methyl-orange and phenol phthalein solutions are in use for detecting acidity and alkalinity, respectively, by "spotting" on the fabric.

These tests were presumably accepted as satisfactory, *prima facie*, until attention was called to the discovery that cotton exhibits a preferential attraction for the basic constituent of a neutral salt in aqueous solution, and thus produces an acid reaction in the solution (cf. Cameron, U.S. Dept. Agr. Bur. Soils, Bull. 30, p.60, and "The Soil Solution," 1911, p.66; Truog, Jl. Phys. Chem. 1916, **20,** 457; and Willows, Jl. Text. Inst. 1919, **10,** 161). In consequence, the British Engineering Standards Association specify that in determining the acidity or alkalinity of aeroplane fabric, an aqueous extract prepared according to their prescription should be titrated in the absence of the fabric. This may perhaps be satisfactory for the purpose in view, but does not give, nor is it claimed to give, the true amount of acid or alkali originally present in the fabric. It has indeed already been shown (Zänker and Schnabel, Färb. Zeit. 1913, 282) that cotton retains adsorbed sulphuric acid with such tenacity as to introduce considerable errors into the estimation of small amounts of that acid by titration of an aqueous extract of cloth. Moreover, S. H. Higgins (Jl. Soc. Dyers and Col., 1918, **34,** 35) has met the same difficulty, for he speaks of "acid which it is practically impossible entirely to wash out of the cloth" by means of boiling water.

In view of the above criticisms, it was decided to attempt the preparation of samples of neutral cloth by washing in pure water two samples of cloth, one definitely acid, the other definitely alkaline, until the difference between the two could be proved to be negligibly small.

PREPARATION OF A NEUTRAL (BLEACHED) COTTON FABRIC.

A high quality calico of Egyptian cotton, well bleached and free from size and from oxycellulose, was used as a starting-point. One specimen was soaked in dilute caustic soda, another in dilute hydrochloric acid, in the cold, for several hours. The alkaline solution remained alkaline, the acid remained acid, during this period, and therefore the fabrics were doubtless alkaline and acid respectively when removed from the solution. They were placed in large beakers, the alkaline fabric in a silver beaker, the acid fabric in a quartz beaker, and extracted with boiling neutral distilled water repeatedly. In the course of this purification, the two samples of fabric had gradually approximated to each other; it remained to be proved how nearly each approached neutrality. The first step was to dry the samples and to examine them by "spotting" with solutions of various indicators. Methyl red was the only indicator which showed any difference between the two; the fabric originally alkaline showed a neutral tint; the other gave a purer red, free from yellow. The second step was to soak into the fabric originally alkaline an aqueous solution of hydrochloric acid containing 0·005% acid calculated on the weight of the cloth, to dry, and to test again with methyl red. The colour observed was indistinguishable from that given by the fabric originally acid. Finally, this latter fabric, by treatment with an equivalent amount of alkali, gave a definite alkaline reaction with methyl red. Hence, neither fabric was further removed from neutrality than 0·005% alkalinity or acidity respectively. This was a sufficiently close approximation for our purpose.

It may be mentioned that when suitably "conditioned" after the above treatments neither sample of fabric had lost strength, as determined by a tensile test on the Goodbrand machine, nor did either of them lose strength by heating to 98°C. for 60 minutes, followed by "conditioning."

The above method for obtaining neutral fabric is laborious, and can be much simplified with the aid of the methyl red test, since this gives a proof of a sufficiently close approach to neutrality for the purpose. By this means, we have found that boiling out an acidified fabric with a dilute solution of common salt removes acid more rapidly than does pure water. Still simpler is the washing of acid-treated fabric in filtered cold water of slight alkalinity, which will rapidly neutralise the fabric without causing any increase in the ash of the fabric. Finally, a commercial fabric which, after desizing and washing in water, gives a neutral reaction with methyl-red, is neutral within ·005% HCl or the equivalent of acid or alkali.

QUANTITATIVE ESTIMATION OF ACID AND ALKALI IN CLOTH.

The first method examined was that used for testing aeroplane fabric, according to the specifications issued by the British Engineering Standards Association. This consists, briefly, in twice extracting the sample with boiling water and titrating the mixed extract with N/100 caustic soda. In order to meet the requirements of the Association, not more than 1 cc. of the alkali should be needed to neutralise the acid extracted from 6 inches square (3·3 grams) of the fabric. We found, however, that after the addition of known small amounts of sulphuric acid to a neutral bleached cloth which was then air-dried at laboratory temperature, an estimation by the above method showed that the cloth retained up to about ·05% of its weight of acid and reacted strongly acid to several indicators. The following figures illustrate the point:—

TABLE I.

Acid added to cloth (gr. H_2SO_4 per 100 gr. cloth).	Acid extracted from cloth (gr. H_2SO_4 per 100 gr. cloth).	Acid remaining in cloth.
0·008	0·000	0·008
0·020	0·006	0·014
0·029	0·007	0·022
0·061	0·018	0·043
0·100	0·050	0·050
0·210	0·165	0·045

At low concentrations of acid, of the order of a few hundredths of one per cent., the amount not extracted therefore is larger than that extracted. It is exactly in this region of concentrations that the tendering effect of acid becomes marked in favourable circumstances.

The second method examined was the older one, namely, titration directly in the presence of the cloth. The following tables contain all the results of several series of titrations of prepared fabrics:—

TABLE II.

Indicator : Phenol phthalein.

Acid added to cloth (gr. acid per 100 gr. cloth).		Acid estimated in cloth (gr. acid per 100 gr. cloth).	Error of estimation
·008	H_2SO_4	·013	·005
·017	,,	·026	·009
·019	,,	·022	+ ·003
·025	,,	·033	·008
·033	,,	·034	+ ·001
·033*	,,	·040	·007
·039	,,	·031	·008
·060	,,	·060	nil.
·065	,,	·056	– ·009
·065	HCl	·052	– ·013
·066	H_2SO_4	·065	- ·001
·099	,,	·098	·001
·100	,,	·097	·003
·127	HCl	·128	+ ·001
·200	H_2SO_4	·192	·008
·262	HCl	·252	·010

* A sample of mercerised fabric was used for this experiment.

TABLE III·

Indicator : Brom thymol blue.

·005	H_2SO_4	·006	+ ·001
·009	,,	·009	nil.
·013	HCl	·019	+ ·006
·018	H_2SO_4	·012	– ·006
·026	HCl	·021	– ·005
·045	H_2SO_4	·042	·003
·090	,,	·100	+ ·010
·182	,,	·186	+ ·004

Results of this order of accuracy require some care in titration. For example, a solution which is slightly alkaline and contains phenol phthalein is decolorised by the carbon dioxide introduced with a piece of cloth. A paper by McBain " On the use of phenol phthalein as an indicator " (Jl. C. S., 1912, **101,** 814) may usefully be read in this connection. The procedure which we recommend is as follows:—100 cc. of distilled water are introduced into a clean conical flask of resistance glass, brought to the boil, 1 cc. of 0·5% phenol phthalein solution (in alcohol) is added and the whole is titrated with N/50 NaOH, until a very faint colour, just visible against a white background, and permanent for 10 minutes, is obtained. The flask is loosely stoppered during standing. Three grams of the cloth under examination are then added and the liquid is boiled for a few minutes. (A neutral fabric has no more effect on the reaction of the liquid than is represented by 0·1 cc. N/50 NaOH, maximum.) The liquid is then titrated with N/50 NaOH until the colour remains permanent in the closed flask for 10 minutes. Until experience is gained, the colour may be compared with a standard made from a suitable mixture of cobalt nitrate and copper sulphate solutions (McBain, loc. cit.).

If, in the course of the estimation described above, the colour of the solution is not discharged but rather intensified on introduction of the cloth, then the latter is alkaline, or possesses acid-neutralising properties due, for example, to calcium carbonate. The correct procedure is then to add a measured excess of N/50 sulphuric acid, to boil for ten minutes, and to titrate back with alkali to the standard pale pink. Some estimations of the alkalinity of fabric into which known amounts of alkali (NaOH solution) had been dried are given in Table IV. The alkali had become largely carbonated during drying, but the results are expressed as percentages of sodium hydroxide.

TABLE IV.

Alkali added to cloth (gr. NaOH per 100 gr. cloth)	Alkali estimated in cloth (gr. NaOH per 100 gr. cloth)	Error of titration.
·027	·020	·007
·082	·075	– ·007
·143	·148	+ ·005
·143	·133	·010
·287	·270	– ·017
·287	·274	– ·013

It appears that in the determination of alkali the results are correct within two-hundredths of one per cent.

N/50 solutions give more accurate end-points than can be obtained with stronger solutions; no increase in accuracy seems attainable with N/100 solutions.

The phenomenon of preferential adsorption of base is proved by the above figures to be of no moment in the acidimetry of almost pure cellulose, free from fats, waxes, proteins, and containing 0·07 to 0·10 per cent. of ash constituents, when the object is an accuracy of about 0·01%. This conclusion is further supported by experiments in which neutral salts such as sodium chloride and sodium sulphate were added to the solution at the end of a titration, when no change of colour was observed.

An examination was made of another method of acidimetry, possibly applicable to cotton, namely titration of the iodine liberated from a solution of potassium iodide and iodate. The results obtained were not so good as those given by titration with N/50 alkali in the presence of the cloth, but were better than the results of the first method quoted above.

Finally, attention may be called to the approximate evaluation of acidity by "spotting" with various indicators.

SENSITIVITY OF INDICATORS TOWARDS ACID AND ALKALI ON FABRIC.

From neutral fabrics obtained by the first method, described above, samples of standard acid and alkali content were prepared by absorbing in a weighed piece of fabric the whole of a solution containing the requisite amount of acid or alkali, the process being conducted as uniformly as possible in order to ensure even distribution. The fabric was then allowed to dry in the air in a room free from laboratory fumes. With such prepared samples, a series of indicators was tested. Below are quoted those results which appear to be of most interest:—

Methyl Red.—A saturated solution in water gave a bright red colour when dropped on to cloth containing 0·005% acid, and a yellow colour with 0·005% alkali in cloth. This indicator is good for ascertaining whether a cloth is well washed commercially.

Lacmoid.—A 0·5% solution of lacmoid (British Drug Houses) in alcohol gave a bright red ring with a blue centre with cloth of acidity from ·03% to about ·06%. The proportion of blue to red area decreased with increase in acidity and with time, and thus gave a rough measure of the amount of acid present.

The indications were somewhat different in the case of a fabric which was not fully bleached and in consequence wetted badly with aqueous solutions. The alcoholic lacmoid wetted the fabric readily, but no redness was produced by acidities from ·03 to ·05%. This was presumably due to a slower release of interfibrillar acid, so that as the drop spread it did not carry forward the acid necessary to produce the red ring.

Methyl Orange.—A 0·01% solution in water gave indications of acidity only when the proportion of acid exceeded about 0·10 per cent. sulphuric acid. The pure red colour of the indicator is reached at about 0·16 per cent. sulphuric acid.

Potassium Iodide-Iodate-Starch.—This indicator, recommended by J. F. Briggs (Jl. S. C. I., 1916, **35**, 78) shows the presence of acid from about 0·01% upwards, by a blue colouration which develops at a rate varying considerably with the amount of acid present and with the concentration of the indicator. We have found that the test mixture can be conveniently prepared by dissolving 2 grams of potassium iodide and 1 gram of potassium iodate in 100 cc. of water, boiling until a drop, cooled and diluted, gives no colour with starch solution, then making up to 100 cc. with neutral water and adding a solution (made at the boiling point) of 1 gram of starch in 50 cc. of water. The mixture keeps well only when the carbon dioxide of the air is entirely excluded.

Phenol Phthalein.—A 0·5% solution in 60% alcohol gives no visible colouration on fabric containing sodium carbonate until the amount of the latter reaches the equivalent of about 0·12% NaOH of the weight of the fabric. The colour produced by this amount of alkali is quite faint in the circumstances of a " spot " test.

Brom Thymol Blue.—A 0·04% neutralised solution in water gives a yellow colour with neutral fabric and a green colour with fabric containing sodium carbonate equivalent to about 0·02% NaOH. This colour becomes blue with the equivalent of about 0·04% NaOH.

Thymol Blue.—A 0·04% neutralised solution in water gives a purple colour with fabric containing upwards of about 0·16% sulphuric acid.

Litmus.—The well-known objections to litmus solution are magnified in connection with the testing of cloth. Its colour is not strong, and the colour change is not sharp. Litmus paper is, however, considerably more sensitive when pressed between layers of moistened fabric for a few minutes, or when the moistened test paper is pressed upon the suspected fabric. A slight colour change is observed with ·01% of acid or alkali.

The choice of an indicator for commercial testing of fabric is not determined solely by high sensitivity, however, but by sensitivity such as will show a definite colour-change when the amount of impurity approaches the danger line—a subject which we do not propose to discuss here.

OTHER COTTON CLOTH AND INDICATORS.

The above conclusions are based on experiments with well-bleached but not " finished " cloth. Commercially " finished " cloth is frequently difficult to wet with aqueous solutions such as the iodide-iodate-starch reagent, and, therefore, the choice is restricted to alcoholic indicators. It might be possible to use enough alcohol or other solvent or wetting-agent to enable iodide-iodate-starch mixtures to wet all finished cloth, but this has not been tried.

Dyed fabric presents difficulties which are generally surmounted by a quantitative estimation. If, however, the dyestuff " bleeds " into the solution, it may be necessary to determine the acidity of a solution with which the fabric is in chemical equilibrium, by such means as are available for the purpose, and to compare the results with those obtained from fabric of known acid content.

Methods for the detection and estimation of acid in grey cloth are still to be investigated.

POSSIBLE INTERFERENCE, WITH INDICATOR REACTION, BY NEUTRAL SALTS.

A neutral cloth " spotted " with various indicators shows no change in reaction when crystals of a neutral salt are dropped on to the wet patches of indicator solution. Differential adsorption of base and acid, therefore, does not occur to such an extent as to interfere with the delicate reaction of the indicator.

Calcium carbonate is not neutral; by virtue of hydrolytic decomposition it gives an alkaline reaction with brom thymol blue. Even Iceland spar exhibits alkalinity to indicators as sensitive as brom thymol blue.

COMPARATIVE EFFECTS OF VARIOUS ACIDS.

The experiments described above refer to the acids which the bleacher may commonly leave in his fabric, namely, the strong mineral acids, sulphuric and hydrochloric. It is possible that weaker acids such as acetic and the soap acids may be present; these are harmless to cloth, but may affect indicators. In the case of most indicators the colour change depends on the concentration of hydrogen-ions present and the potentiality for damage to cloth depends on the possibility of increase of hydrogen-ion concentration on evaporation. Some discrimination is necessary, because, for example, a cloth containing a potentially harmful amount of strong mineral acid may be treated with neutral soap so as to replace the mineral acid by its chemical equivalent of weak organic acid. The latter would liberate from the iodide-iodate mixture the same amount of iodine as the former; titration in the presence of most indicators would yield approximately the same results, but the reaction with "spotted" coloured indicators such as lacmoid and methyl orange would be different. By careful comparison of the two effects, on a roughly quantitative basis, a distinction may be drawn between the two types of acid; for this the very sensitive indicators such as brom thymol blue and methyl red are useless.

SUMMARY.

Acidimetry (correct to 0·01% HCl or H_2SO_4) and alkalimetry (correct to 0·02% NaOH, present as Na_2CO_3) of bleached cotton cloth can be accurately carried out by titrations with N/50 solutions, at the boil, in the presence of the fabric, with phenol-phthalein as indicator.

Errors amounting to as much as 0·05% sulphuric acid may be incurred by titrating the aqueous extract of cotton according to the procedure recommended by a recent specification. These errors are due to the well-known stubborn retention of acid by the fabric.

Coloured indicators of suitable strength can be used for the approximate estimation of acidity and alkalinity of fabric, by "spotting" on the fabric. Approximate figures for the changes of colour indicated are :—

Indicator.	Acidity or alkalinity	Colour.
Thymol Blue	0·16 % H_2SO_4 & upwards	Purple.
Methyl Orange	0·10–0·16 % H_2SO_4	Intermediate (yellow-red)
Lacmoid	0·06 % H_2SO_4 & upwards	Red.
Lacmoid	0·03 – 0·06 % H_2SO_4	Blue centre, red ring.
Lacmoid	0·02 % H_2SO_4 & less	Blue.
KI–KIO_3–Starch	0·01 % & upwards	Blue, increasing in intensity.
Methyl Red	0·005 % H_2SO_4 & upwards	Red.
Methyl Red	0·005 % Na OH present as Na_2CO_3 & upwards	Yellow.
Brom Thymol Blue	0·02 % NaOH (present as Na_2CO_3)	Green.
Brom Thymol Blue	0·04 % NaOH & upwards	Blue.
Phenol phthalein	0·12 % NaOH & upwards	Pink, increasing in intensity.

The equivalent of hydrochloric acid can replace sulphuric acid in the above data.

The absorption of CO_2 from the air by Na_2CO_3 gradually reduces the alkaline reaction of the latter and increases correspondingly the lower limit at which colour changes with indicators become apparent.

Acknowledgment is made to the Tootal Broadhurst, Lee Co., Ltd., for permission to publish these results.

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THE SORPTION OF NEUTRAL SOAP BY WOOL, AND ITS BEARING ON SCOURING AND MILLING PROCESSES

(Contributed by the British Research Association for the Woollen and Worsted Industries.)

INTRODUCTION

This investigation forms part of the general scheme proposed for the determination of the amounts of various reagents taken up by wool from solution. Reagents, in this sense, include soap, acids, alkalies, dyes, and other " chemicals " used in the trade.

Reliable information on the quantity of such substances absorbed by wool will assist the understanding and investigation of the various processes in which they are employed.

It will be noted that the word " sorption " has been used in preference to the more usual word " absorption." The reason for this is that absorption now has a somewhat restricted meaning, being contrasted with the word " adsorption." The former is used to denote the taking of a substance into the interior of the " sorbing " medium, and the latter to denote the accumulating of a substance at the surface layer of the " sorbing " medium. The word " sorption " is used in a non-committal sense to denote the removal of a component from a solution irrespective of the precise mode of action, whether chemical or physical in the first place, or in the latter case whether the substance effecting this removal takes the component into its interior (*i.e.*, absorbs it) or accumulates it on its surface (*i.e.*, adsorbs it).

In the case of wool, where there is conflict of opinion as to how far the taking up of reagents (*e.g.*, acids and dyestuffs) is a chemical action, and how far physical, " sorption " appears to be the most appropriate term to use.

GENERAL

The question of the sorption effects between wool and soap solutions is of great theoretical interest in connection with the constitution of these materials and the mode in which the transference of the alkali and fatty acid from the solution to the wool takes place. In addition, it has an important practical side with regard to the function of soap in milling and also regarding the effect of the sorbed portion upon the wool and the extent of this sorption with soaps of different kinds.

Previous Work.—One of the principal results arrived at by the present writer is supported by some earlier work by Woodmansey[1], who found that " not only was there a pronounced adsorption of the basic portion, but this occurred in greater ratio than corresponded with the simultaneously absorbed fatty acid. In other words, an acid soap remained in the bath."

Method of present work.—The method adopted in the present paper consists essentially in placing the wool in the soap solution for a definite time at constant temperature, and then withdrawing a sample of the liquor and determining its alkali and fatty acid content. The portion sorbed is thus obtained by difference. This is the method usually adopted for work of this kind, but, as the values are indirectly obtained, careful consideration is required as to what information is really available from the numerical data afforded by such an experiment.

Theory of Method.—The general theory of this experimental method may be stated thus:—

If a sorbing material S be placed in an aqueous solution of a substance X, there will be a decrease, no change, or an increase in the concentration of the solution, according as the ratio of the sorbed amounts of X and of water is greater than, equal to, or less than, the ratio of the amounts of X and water in the solution.

It is clear, therefore, that, given merely the initial volume and initial and final concentrations of the solution, we can only calculate the *difference* between the amount of X which is really sorbed and the amount of X in that quantity of residual solution which represents the change in volume.

Obviously, the fact that no change in concentration is observed indicates generally that the components are sorbed in the same proportions as are present in the solution, and does not necessarily mean that no sorption has taken place.

The usual method of calculating the quantity sorbed:—

Original volume of solution (litres) x diminution of concentration (grs. per litre).. A

is thus incorrect.

In most actual cases, the solution is dilute and the sorption relatively large, so that the error is negligible.

In the case of strong solutions, however, the error may become very considerable. In such cases, it is necessary to estimate its magnitude.

The true value for the amount of x sorbed is the difference between the initial and final values of the product.

Volume of solution x concentration of solution.................... B

and this obviously exceeds the approximate value A by the amount.

Final value of concentration x diminution of volume of solution... C

Thus $B = A + C$.

(In some cases, *e.g.*, in alcoholic solutions, C will be negative with hygroscopic materials, such as wool.)

The measurement of the final volume of solution, however, is a difficult matter. Squeezing or even centrifuging the wool still leaves a certain amount of liquor which cannot be regarded as truly sorbed. In the case of soap solutions, frothing adds further to the difficulty.

The ideal method would be to measure the difference (if any) in the *total* volume of wool plus solution before and after contact and the change in volume of the wool from measurement of the swelling of the wool fibre. Thus, assuming there were no change in total volume, the diminution in volume of solution would be equal to the increase in volume of the wool.

The matter, which presents difficulties both of a practical and theoretical nature, is at present under consideration.

In the present paper, the approximate values of the sorbed quantities have been calculated according to formula A, and a rough correction applied by making an assumption based on our knowledge of the amount of water sorbed by wool.

EXPERIMENTAL DETAILS

Materials.—The wool employed was obtained from raw Sydney 60's in as pure a state as possible to avoid any secondary effects due to foreign matter.

For its preparation, three or four locks were tied across the middle with cotton thread in bundles, and each bundle carefully scoured with Stephenson's potash olive soap, the first bath containing 0·2% soap and

0·1% soda, and the second 0·2% soap only. The knot was slipped along to another position during the scouring to ensure thorough cleansing. Scoured in this way, very little matting took place. After thorough soaking in successive baths of distilled water, followed by centrifuging, the bundles were hand combed to remove all neps and burrs, and then boiled for periods of half an hour with three successive quantities of absolute alcohol, centrifuging after each treatment. The last alcoholic extract showed only a very faint film of residue, and, as this persisted with oft-repeated extraction of a sample, further purification was not attempted.

The soap, made from "pure" oleic acid and sodium carbonate, was purified by extraction with hot alcohol. The product so obtained was again extracted and deposited from alcohol with the object of avoiding any trace of alkalinity. Actually, the purified soap showed on analysis a slight excess of fatty acid:

100 parts soap contain 102·6 parts $NaOH$ (calc. as oleate)
104·5 parts fatty acid (as Na Oleate).

Molecular weight of fatty acid 270.

Presence of a proportion of solid fatty acid of lower M.W. accounts for the high value calculated as sodium oleate, but further analysis did not appear necessary for the purpose in view.

Method.—The soap solutions were made up from this material with boiled-out, distilled water. Quantities, in the proportion of three grams of wool weighed against a three-gram sample as tare (15% regain) to 100cc of soap solution, were placed for a period of two hours in each case, in flasks of similar size, kept at 25° C in a thermostat, with occasional shaking. A blank sample of solution was analysed under the same conditions as the actual experiment, as a check against possible differences due to action of the alkali on the glass vessels. This action, however, was negligible at the temperature employed.

For the analysis, the wool was withdrawn by forceps through the narrow neck of the flask, which squeezed out most of the liquor. A measured volume of the residual liquor was pipetted off, treated with excess of standard sulphuric acid of a convenient strength, raised to boiling, and, after cooling, the total fatty acid separated by systematic ether extraction. The aqueous portion was titrated boiling, with phenolphthalein as indicator, with carbonate-free caustic soda for the total alkali, while the ether residue, dissolved in absolute alcohol and titrated with caustic soda, gave the total fatty acid. A high degree of accuracy is not to be expected, but accurate values are of less importance than the general trend of the results, which are shown in Table I.

Columns I to V contain the experimental data from which the quantities given in columns VI to XVII are calculated. The "uncorrected" values are based on formula A. The "corrected" values are calculated (by means of formula B) on the assumption that in every case 100cc of solution are diminished by 0·6cc. This corresponds roughly to the assumption that the wool absorbs 20% of its weight of water. The initial condition of the wool being 15% regain and the condition of wool in water 33%, this assumption is not unreasonable. The graphs are constructed from these corrected values.

PREFERENTIAL SORPTION OF ALKALI

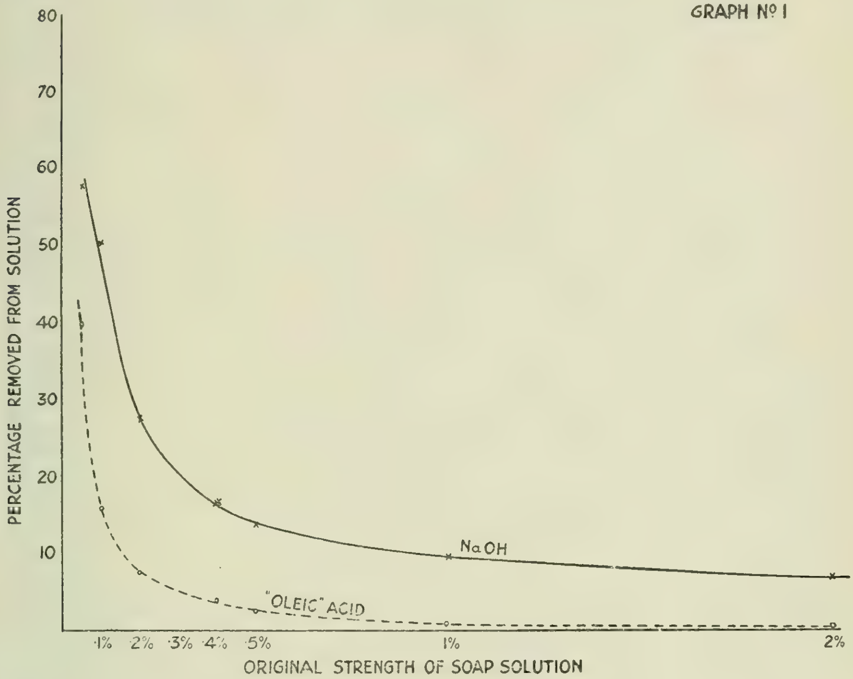
The much greater sorption of alkali than fatty acid is obvious from graph No. 1 which shows the percentages and also the relative amounts of caustic soda and fatty acid lost from solution. The vertical distance between the curves thus represents the proportion of liberated fatty acid which remains in the solution.

TABLE I.

I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.	XVI.	XVII.
Strength of Soap solution.	50 c.c from blank contain :—		50 c.c from wool contain :—		% loss from solution.				100 grams of wool remove from solution :—							
					Uncorrected.		Corrected.		Uncorrected.		Corrected.		Uncorrected.		Corrected.	
													Gram equivalents.		Gram equivalents.	
	Total NaOH as oleate.	Total fatty acid as oleate	Total NaOH as oleate.	Total fatty acid as oleate	NaOH	Oleic.	NaOH.	Oleic.	Grams NaOH.	Grams Oleic.	Grams NaOH.	Grams Oleic.	NaOH.	Oleic.	NaOH.	Oleic.
5 %	2·597	2·6101	2·525	2·620	2·8	–0·38	3·35	0·23	0·63	–0·61	0·762	0·377	0·0157	–0·00217	0·019	0·00133
2 %	1·026	1·0470	0·966	1·048	5·9	–0·1	6·38	0·48	0·52	–0·06	0·575	0·31	0·013	–0·00022	0·0144	0·00113
1 %	0·517	0·5205	0·470	0·5191	9·1	0·27	9·63	0·86	0·41	0·087	0·437	0·278	0·0102	0·00031	0·0109	0·00098
0·5 %	0·2267	0·2650	0·2317	0·2597	13·1	2·0	13·65	2·6	0·31	0·32	0·319	0·427	0·0077	0·00113	0·0079	0·00151
0·4 %	0·2050	0·2080	0·1724	0·2010	15·9	3·36	16·42	3·94	0·286	0·432	0·295	0·507	0·0071	0·00153	0·0074	0·00180
0·2 %	0·1026	0·1085	0·0751	0·1011	26·8	6·8	27·24	7·42	0·24	0·458	0·245	0·50	0·0060	0·00162	0·0061	0·00177
0·1 %	0·050	0·0530	0·025	0·045	50·0	15·1	50·3	15·6	0·219	0·495	0·221	0·512	0·0055	0·0017	0·0055	0·00182
0·05 %	0·0246	0·0280	0·0105	0·017	57·3	39·3	57·5	39·6	0·120	0·68	0·124	0·687	0·0030	0·00241	0·0031	0·00244

Another significant point is the mode of variation of the amount of fatty acid sorbed with the concentration of the soap solution.

The uncorrected value increases rapidly as the concentration increases from zero, attains a maximum, diminishes to zero in the neighbourhood of 1%, and then actually becomes negative. On making the correction, which, on the assumption made above, is proportional to the concentration of the soap solution, the corrected curve (see Graphs 2 and 3) indicates a rapid rise from zero to a maximum at a concentration less than the smallest experimental value, a less rapid fall to a minimum in the neighbourhood of 1%, and a very slow rise beyond this point.



PRECIPITATION OF FATTY ACID

This peculiar mode of variation of the amount of fatty acid sorbed suggests that the process of sorption is not merely

(*a*) sorption of soap, as such, which has been generally assumed to account for the presence of soap on wool, and

(*b*) preferential sorption of alkali, liberating a corresponding amount of fatty acid,

but that there is a third effect,

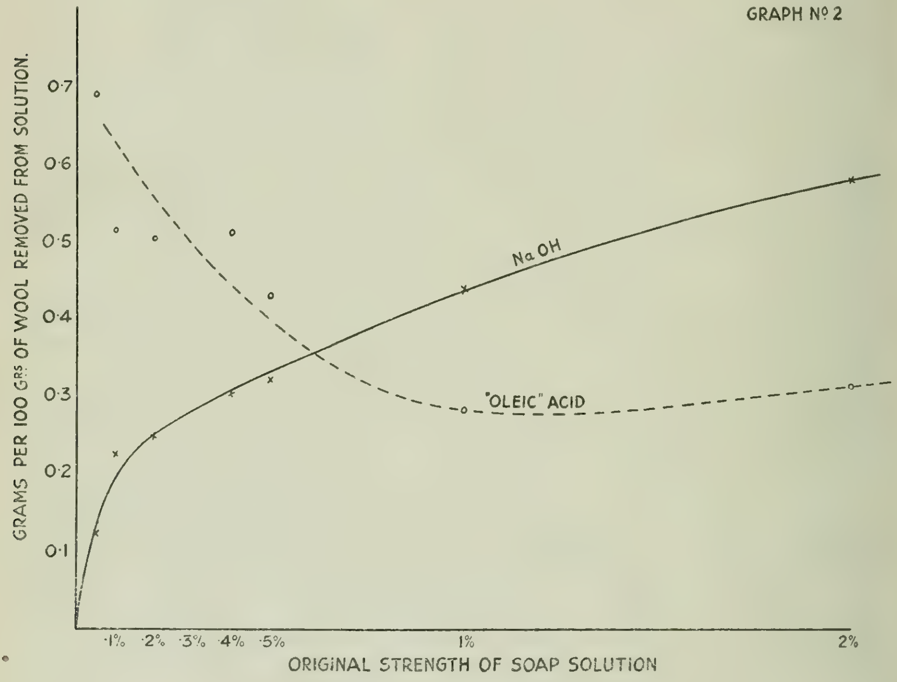
(*c*) precipitation on the wool fibre of a portion of this liberated fatty acid.

(For the sake of clearness, the excess of fatty acid over alkali in a soap solution is referred to as free fatty acid, though work by McBain and others[2] indicates that it is actually present in the form of acid salts of variable composition).

It is difficult to explain on any other assumption the increase in the absolute amount of fatty acid sorbed as the concentration of the soap solution falls below 1%. Moreover, the known protective colloid action of soap solutions lends support to this hypothesis. This protective action should prevent the precipitation at the higher concentrations, while its effectiveness should diminish with increasing dilution.

This failure to prevent precipitation begins at a rather higher concentration than would be expected from the experiments of Spring and various other workers[3] on neutral soaps, but it must be remembered that the present case concerns not neutral soap solutions, but solutions containing excess of fatty acid.

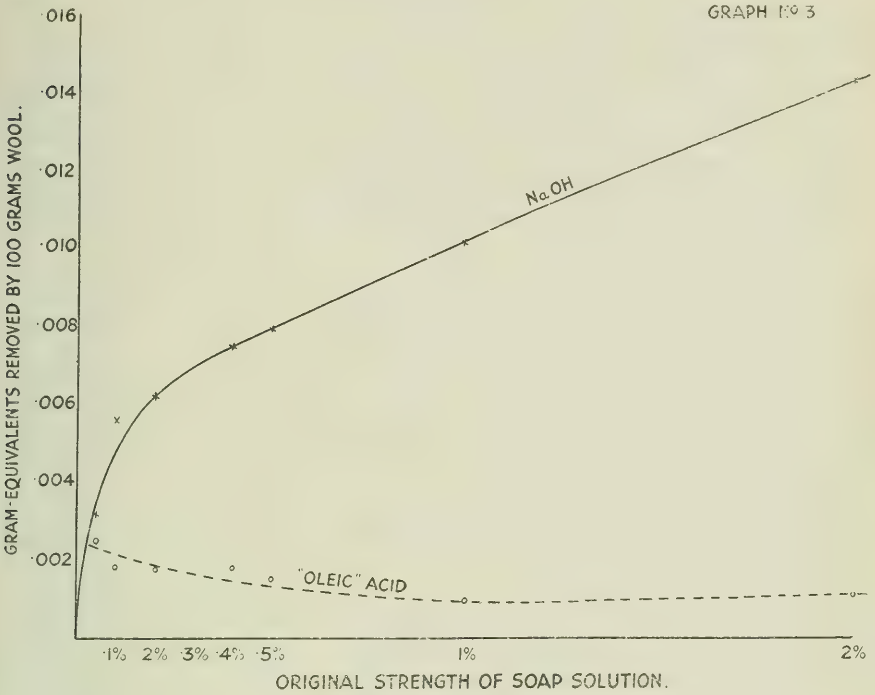
It may be inferred from this that, with strong solutions, the fatty acid is sorbed mainly in the form of neutral soap, but that, with the dilute solutions normally employed in scouring, the presence of fatty acid is mainly the result of the precipitation process above referred to.



ANALYSIS OF SOAP ON WOOL

It may be well to remark here upon the apparent anomaly that, though the ordinary analytical methods indicate presence of "*acid*" soap on scoured wool, the sum total of alkali and fatty acid taken up by wool from neutral soap solution is always *basic* in composition. This is explained partly by the observed fact that the alkali is washed out more rapidly than the fatty acid on rinsing the scoured wool with water (see also p. 140, line 6), and partly by failure of the usual analytical methods to detect the sorbed alkali. The latter point is fully dealt with in a separate report[4] in which it is shown that a given quantity of soap dried on to a piece of cloth only yields up part of the alkali to acidimetric estimation. Thus, attempts to determine the sorption effects in the case of soap, by direct analysis of the wool, would lead to incorrect results.

It will be noted that, in Graphs 1, 2, and 3, the values are plotted against the *original strengths* of the soap solutions. It is simpler to express them in this way, in view of the changes in relative amount of the components of the soap, instead of plotting against the new concentrations of the latter, which is the usual and preferable method where a definite equilibrium is attained. It was found, however, that after several hours' contact there was no sign of equilibrium.



TIME FACTOR

To investigate this point, a sample of wool was dry cleaned with carbon tetrachloride, alcohol-extracted, rinsed thoroughly with distilled water, and again alcohol-extracted. It was thus not subjected to any soap or alkali other than may have been originally present in the fleece. The effect of a 0·25% solution of a sodium oleate-palmitate soap (iodine value of fatty acids 64) was then investigated over a period of 40 hours. The results are given in Table II. The values of the sorbed quantities are calculated from Formula A (and are, therefore, uncorrected values) and are expressed as percentages of the amounts originally present in the solution. The remaining tables are similarly derived.

TABLE II.

Period of Contact.	% loss of Alkali.	% loss of fatty acid.
2 minutes (approx.)	10	0·2
10 ,,	13	2·0
2 hours	22·4	5·0
16 ,,	40·7	12·5
40 ,,	46·4	18·7

It is evident that the process of sorption continues for a very considerable period without any sign of equilibrium. It will also be seen that, in the initial stages, the rate of loss of alkali is much greater than that of the fatty acid. This difference may be exaggerated by the fact that the above are uncorrected values, but still remains supposing the amount corresponding to the correction (0·6% loss) to be sorbed in the first two minutes. In the final stages, the rates of loss of alkali and fatty acid are roughly equal.

PRECIPITATION OR SORPTION?

At first sight this difference may appear to afford independent proof that the fatty acid is merely precipitated and not sorbed as soap. It is the expected result on this hypothesis:—Soap is partly hydrolysed in aqueous solution into caustic soda and a weak fatty acid (in the form of acid salts) and the hydrolysis-caustic soda is the active agent. Its continuous sorption into the wool brings about continuous hydrolysis of the residual soap to re-establish equilibrium. Fatty acid (or acid soap) is thus continuously liberated, and this fatty acid (or acid soap) is partly deposited, but this deposition is delayed by the protective colloid action of the residual soap solution.

It is, however, also to be expected on the theory that the fatty acid is sorbed as soap. The rates of sorption will be governed by the rates of diffusion, and the diffusion will be more rapid in the case of the alkali.

The above difference in rate of sorption is also in agreement with the observation of Shorter and Ellingworth[5] that the formation of a soap layer at the interface between oil and an aqueous solution is more rapid when the soap is formed by the inter-action of alkali in the aqueous solution and fatty acid in the oil, than when the soap layer is formed by deposition of the soap from the solution.

There is, moreover, evidence that caustic soda combines chemically with wool, in which event it must be removed in greater quantity than would be the case if physical sorption alone, with a resulting equilibrium, took place.

Further, a comparison may be made with the behaviour of salts in general. The sorptive action of wool (which is at least potentially if not actually amphoteric, *i.e.*, both acid and basic, in character) towards acids and alkalies is well known. Also, a solution of a salt which is appreciably hydrolysed by water is altered in composition when wool is immersed in it. Thus, aluminium chloride becomes relatively weaker in hydrochloric acid, whilst sodium carbonate becomes relatively weaker in caustic soda.

On the other hand, salts like sodium chloride, which are neutral in aqueous solution, are usually described as being "negatively sorbed"; that is to say, the solutions appear more concentrated, since water is sorbed by the wool, but the salt either not at all, or in proportionately smaller quantity. The difficulty regarding this point has been already discussed (see p.128, line 8), but it appears from work shortly to be published on the swelling of wool fibre, that the swelling in sodium chloride solutions up to 10% is sensibly the same as in pure water, and it should, therefore, be possible, by the method suggested, to determine if the true sorption value for sodium chloride, and for neutral salts in general, is actually zero, or a positive quantity. If positive, it would be legitimate to infer that neutral soap is actually sorbed as such; if zero, the presence of fatty acid on the wool would have to be explained on the precipitation hypothesis.

It is also probable that, while the stronger acids and bases penetrate the wool fibre, neutral substances do not. Thus, Droaper[6] remarks that the reason certain dye stuffs soluble in alcohol are not extracted by alcohol from wool fibre is that the wool is not permeable to alcohol, which, therefore, cannot get into contact with the dyestuff in the interior. It has been found[7] that, if neutral soap is put directly on to cloth and allowed to dry, the whole of the fatty acid, with about 80% of the alkali, is extracted by alcohol. If caustic soda alone is put on, only 5% is extractable by alcohol. The inference is that, whereas the caustic soda has penetrated the fibre, the residual acid soap is on the surface only, and that, even with the concentrated soap solutions, of the total fatty acid taken out by the wool in the sorption experiments above described, the proportion due to a real surface adsorption effect is possibly small.

EFFECT OF TEMPERATURE

The effect of temperature is shown in Table III, which relates to the sorption after two hours' immersion at temperatures of 25° C, 45° C and 65° C (77° F, 115° F, and 149° F) in a 0·25% solution of the same soap solution as that used in the experiments of Table II.

TABLE III.

Temperature.	% loss of alkali.	% loss of fatty acid.
25° C.	24·1	5·2
45° C.	27·1	10·5
65° C.	35·5	19·2

It will be seen that temperature has a marked effect, and that the effect is greater in the case of the fatty acid than in the case of the alkali. The probable explanation of this on the sorption theory is that cooling produces an increase of viscosity owing to incipient gelatinisation. It is well known that a jelly structure impedes the diffusion of dissolved colloids very much more than that of substances in true solution. (Dissolved salts diffuse almost as quickly through rigid gelatine jellies as through water.) Thus, cooling may be expected to diminish the rate of loss of fatty acid (whether as actual soap or as free fatty acid) much more than that of the alkali.

On the precipitation hypothesis, at the higher temperatures the fatty acid or acid soap is nearer its melting point and will tend more to stick to the wool.

MIXED FATTY ACIDS

Experiments conducted with soaps made from mixed fatty acids (oleic-palmitic) indicate that there is a preferential sorption of the oleic acid, since the iodine value of the fatty acids in the soap solution was decreased by the process of sorption. Table IV gives the results for solutions of two soda soaps made from fatty acids of iodine values 50 and 64.

TABLE IV.

Concentration of soap solution.	Temperature.	Period of sorption (hours.)	Iodine value of fatty acids in soap solution.	
			Before sorption.	After sorption.
0·5 %	25° C.	2	50	47
0·25 %	,,	2	50	45
0·25 %	,,	2	64	63·8
0·25 %	,,	16	64	62
0·25 %	,,	40	64	59

A confirmatory experiment was made using three successive quantities of 12 grams of wool in 400cc of 0·25% soap solution, for periods of two hours each at 25° C. The results were as follows:—

% loss of fatty acid	24·5
% loss of alkali	63·8
Iodine value of original fatty acid	64·0
Iodine value of residual fatty acid	50·6

The residual liquor showed only slight frothing. Its turbidity was much greater than that obtained under the standard conditions, and had the iridescent appearance common with hard acid soaps.

This behaviour is significant in connection with the relative efficiencies of soda and potash soaps (see below).

POTASSIUM OLEATE AND PALMITATE

Table V shows comparative results obtained from potassium oleate (iodine value 85) and potassium palmitate (at 25° C for two hours).

TABLE V.

Concentration.	Potassium oleate. % loss alkali.	Potassium oleate. % loss fatty acid.	Potassium palmitate. % loss alkali.	Potassium palmitate. % loss fatty acid.
0·5 %	12·9	2.8	22·3	1.8
0·5 %	—	—	23·2	1·4
0·25 %	22·0	7·0	32·7	3·8
0·25 %	—	—	35·0	3·5

A greater loss in the case of the palmitate is to be expected. At the temperature employed, the acid products of hydrolysis are in the form of a coarse suspension, *i.e.*, are practically removed from solution, so that the degree of hydrolysis is increased. In addition, there is a marked difference in the fatty acid loss. Though more acid is liberated from the palmitate solutions, less of it is retained by the wool.

A similar comparison of the sodium salts could not be made under the same conditions, owing to the slight solubility of pure sodium palmitate at 25° C. It remains in solution, however, in the presence of sodium oleate, and with such mixtures the same tendency has been noticed, mixtures richer in palmitic acid undergoing the greater loss of alkali and the smaller loss of fatty acid.

Thus, with a 0·25% solution of a soap from a mixture of iodine value 64 gave 22·4 and 5 respectively compared with 20 and 6·1 in the case of an oleate with iodine value 78.

These results are, of course, in agreement with the lowering of the iodine value which occurs during sorption (Table IV).

SODIUM AND POTASSIUM OLEATES

Comparative results with sodium and potassium oleates are given below:—

TABLE VI.

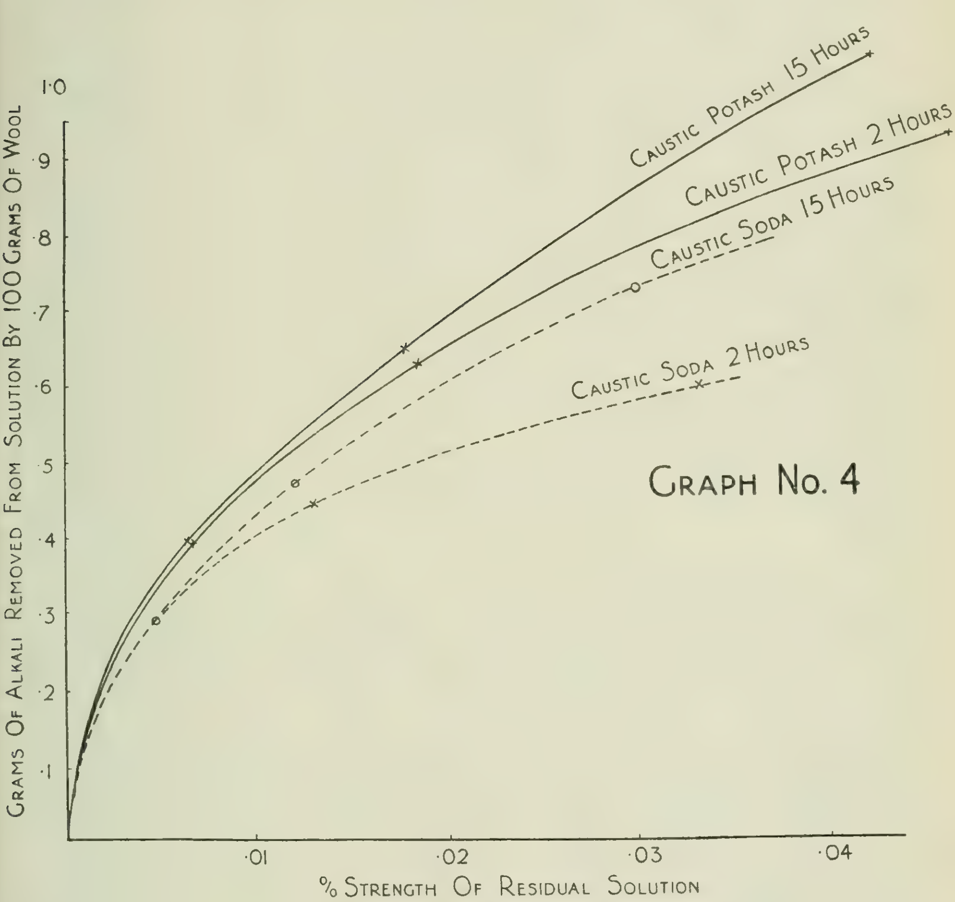
Strength of soap.	Potassium oleate. % loss alkali.	Potassium oleate. % loss fatty acid.	Sodium oleate. % loss alkali.	Sodium oleate. % loss fatty acid.
1 %	8·1	0·7	6·7	0·35
0·5 %	12·9	2·8	11·5	2·1
0·25 %	22·0	7·0	20·0	6·1
0·1 %	—	16·1	—	14·35

Although the losses appear slightly greater for potash, there is not much to choose, as regards the soap "killed," between the two.

SORPTION FROM THE SOLUTIONS OF ALKALI

The alkalinity in aqueous solutions of soaps containing exactly equivalent amounts of alkali and fatty acid is, of course, due to the fact that fatty acids are " weak " acids (*i.e.*, are only slightly dissociated in aqueous solution), so that, in accordance with the well-known laws of chemical equilibrium, aqueous solutions contain an excess of hydroxy ions. A number of other salts (carbonates, borates, phenates, etc., of sodium, potassium and ammonium) show similarly an alkalinity which varies with the " strength " of the acid. Thus, sodium carbonate is more alkaline than sodium borate, but less alkaline than sodium phenate.

In view of the fact that alkaline salts play such an important part in the treatment of wool, a study of their degree of alkalinity is very desirable.



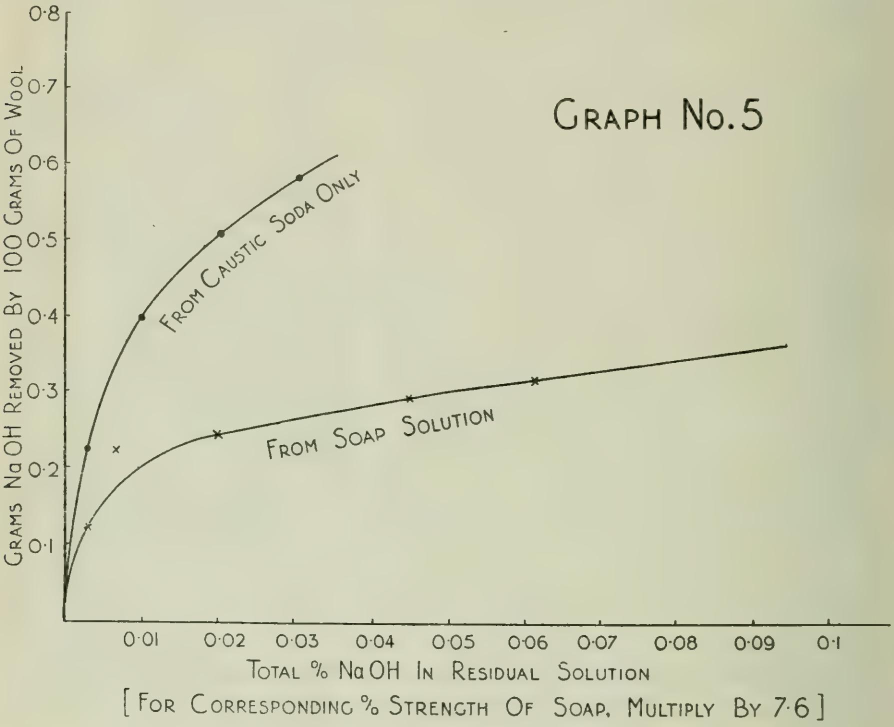
Graph No. 4

One obvious method is to study the sorption of alkali from the salts, and from the corresponding caustic alkali. The concentration of caustic soda giving the same sorption as the salt solution would be some measure of the degree of alkalinity of the salt solution. How far such a measure would correspond to the actual degree of hydrolytic dissociation is an open question, though a rough correspondence may be expected.

Graph No. 4 gives the sorption from solutions of caustic soda and caustic potash under the same conditions as those employed for the soap solutions, and also after 15 hours' contact. (Expressed in chemical equivalents instead of grams, the values for the two bases are practically the same.)

Graph No. 5 gives the alkali sorption from caustic soda solution and from soap solutions under identical conditions. The ratio of the concentration of caustic soda to that of the soap solution giving equal sorption increases with increasing dilution, as is to be expected on the theory of hydrolytic dissociation.

It will also be noticed that the "causticity" of neutral soap solutions of the strengths used in scouring is very small.



A similar curve for sodium carbonate would presumably lie between the curves of Graph No. 5. At present, the sorption from alkaline salts is being studied on these lines in order to obtain a measure of their "causticity," or effective alkalinity towards wool.

THE BEARING OF THE RESULTS ON PRACTICAL SCOURING AND MILLING

I.—*The "Killing" of Soap Solutions by clean wool, and the exhaustion of scouring baths.*

The results of the present paper show that wool has a specific action like that of an acid in killing a soap solution, the extent to which this takes place depending on a number of factors, *e.g.*, concentration of the soap solution, temperature of the bath, time of contact, and the kind of soap used. This causes a considerable loss of soap not contemplated in the ordinary detergent theory.

Alkali and Detergent Theory.—Again, in scouring with an initially neutral soap solution, the latter, owing to the preferential sorption of alkali by the wool, contains, after a short time, excess of fatty acid. There is thus another important reason for using alkali in scouring, also not contemplated in the ordinary detergent theory of its emulsifying action, namely, its chemical function in

(1) prolonging the " life " of the bath;
(2) diminishing the amount of fatty acid contaminating the wool, and consequently
(3) leaving more recoverable fatty acid in the used bath.

II.—Soap and Alkali Solutions in relation to injury of the Wool.

Scouring with neutral soap alone is not practised in the majority of commercial scouring processes. Although alkali is generally added, its use, particularly in caustic form, is viewed sometimes with suspicion, for fear of tendering the material. But, since the " neutral " soap is itself caustic to wool, there is no possibility of eliminating the caustic action entirely, in consequence of which it may be that scoured wool is at a slight disadvantage as compared with dry-cleaned material. It is, therefore, a question of the degree of causticity permissible.

Caustic action of " neutral " soap.—The point is well illustrated by Graph No. 5, which shows the relative " causticity " of caustic soda and " neutral " soap. Lines drawn horizontally will cut the curves at points giving the corresponding strengths of caustic soda and soap which have the same causticity towards wool. If the causticity of the bath is maintained, by continuous addition of alkali, at the original value for the particular strength of neutral soap solution employed, no serious effect on the wool can be anticipated.

Thus, scouring strengths of 0·15% to 0·2% soap would require ·005% caustic soda, or ·007% caustic potash. Similar figures are not yet available for alkali carbonates (*e.g.*, soda ash) but it is obvious that though their chemical equivalents are but slightly greater than those of the caustic alkalies, much greater proportions than these would be required to give the same " causticity."

III.—The Use of Alkali in Scouring.

The judicious use of alkali within the limits above described is obviously beneficial to the scour, as indicated in Section I. It is highly probable, however, that if the bowl were initially made up with caustic alkali in this way, it would be quickly neutralised by the first portions of wool passing through, and the remaining wool would not get the benefit of an alkaline scour.

Latent " causticity " of alkali carbonate.—Therein perhaps lies the advantage of carbonate, which acts as a store of " causticity," and at the scouring temperature progressively yields caustic alkali, carbon dioxide being liberated, with the continual passing of fresh wool through the bowl. With continuous addition of caustic alkali under proper control, the latter should give results at least equal to carbonate, and possibly better, on account of its readier action on acid soap.

Control measurements of the alkalinity of the bowl would seem desirable. It will be quite possible for a bowl originally alkaline to be worked chemically neutral and then acid, long before stopping, inefficient scouring resulting.

Lathering Test.—On the other hand, the practical test of loss of soap, when the liquor is " killed " or devoid of lathering power, is misleading to the extent that considerable real soap may still be present, though mixed with an undue excess of fatty acid, which reduces its efficiency. At first sight there is no reason why this fatty acid should not be made again available in the bowl as real soap. This question, however, is referred to in more ample detail in Section VI.

IV.—The Process of Washing Off.

The well-known resistance of residual soap to washing off is explained in the case of neutral soap solution by the fact that it consists, not of real soap sorbed as such, but of precipitated acid soap resulting from the preferential sorption of alkali by the wool. It is thus already practically insoluble as the cloth leaves the soap solution, and washing with water merely hydrolyses it to still more acid and insoluble products, and thus removes alkali rather than fatty acid. If the soap solution were kept sufficiently alkaline, this precipitation effect would be no doubt minimised, but, from what has been said in Section III, it is highly probable that, even with initially alkaline solutions, in practical scouring the said effect will be considerable.

Now it is obvious that the amount of fatty acid (0·3% is quite usual) found in scoured cloth is far greater than could be derived from the actual liquor left in after squeezing. Thus, assuming cloth to retain 40% of its weight of liquor on squeezing from a 0·1% solution, this would only leave about ·04% of soap in the cloth.

Clearly, the precipitated acid soap must be rendered soluble by chemical means before it can be removed by washing. Ammonia is known to improve washing off. The considerations regarding the use of caustic soda (See Secton II) also apply.

In view of the difficulties of discoloration and uneven dyeing sometimes encountered, which may be attributed in part to the free fatty acid left in the scoured piece and in part to uneven distribution of the sorbed alkali, it may be worth while to consider whether a better removal of fatty acid by such means, followed by a final neutralisation with dilute acetic or other acid, would be of practical advantage. At the same time, the possible loss of handle resulting from such treatment, and means of restoring it, would also have to be considered. On the other hand, so far as the handle is determined by the deposited acid soap, the reason for the deliberate use, in certain cases, of neutral soap without alkali, with the object of "leaving a little soap in," is clear from the results in this paper.

V.—The Relative Efficiencies of Soda and Potash Soaps.

Table VI shows that there is but little to choose, as regards soap "killed," between potash and soda oleates. Pure oleate soaps, however, are never met with in practice, and in proportion to the admixture of palmitate with the oleate, the two bases give diverging results, since the iodine values indicate that the residual liquors become richer in palmitic acid. *Potassium* palmitate scours well at ordinary scouring temperature, but *sodium* palmitate alone only attains its best efficiency at temperatures well above those commonly considered safe for scouring. Thus, at lower temperatures, a potash palm-oleic soap should be capable of being worked right out, while the "life" of a similar sodium soap would appear to depend largely on its oleic content. Further, if the bath is pushed to exhaustion, the wool will tend to get more contaminated in the case of sodium soaps, since sodium palmitate requires a high proportion of oleate to keep it in solution. Experiments with other "hard" fatty acids, *i.e.*, stearic acid, have not yet been tried, but it may be noted that sodium stearate and its acid salts are still less soluble than the palmitates.

The nature of the fatty acid is, in fact, of principal significance from the standpoint of this paper, since caustic potash and soda alone are sorbed in practically equivalent quantities.

Chemical aspect in soap efficiency.—The general efficiency of a wool-scouring soap must be estimated not only from its power of removing neutral dirt and grease, *i.e.*, its detergent power, but also by the extent of its decomposition by wool, and the consequent effect on the wool. The nature of the fatty acid influences the amount of alkali sorbed and of fatty acid left on, the tendency to stain, the handle, and the quality of the material generally.

In short, from the physical standpoint two soaps may scour equally well, but from the chemical standpoint may differ greatly in their effect on wool, and in the amount of wool they can scour.

The method employed in this investigation of determining the loss of alkali and fatty acid from a soap solution under standard conditions will be tested further with a view to its use as an aid to estimating the efficiency of any given soap.

VI.—The Revivifying of Exhausted Baths.

The re-conversion of accumulated acid soap in used baths into active soap is theoretically possible by addition of alkali. As regards caustic alkalies, caustic soda is practicable so far as the oleic acid is concerned, but as pointed out above conversion of palmitic acid to sodium palmitate does not necessarily increase the amount of active soap present, as the latter salt is a very poor soap at lower temperatures. The observation that it is palmitic acid which accumulates in the liquor probably explains why soda does not produce satisfactory regeneration in the bowl.

Caustic potash on the other hand should render both oleic and palmitic available as soap and it seems clear that either as a revivifying agent or as a direct addition to neutral soap to counteract liberation of fatty acid on contact with the wool, potash must be superior to soda. It may be remarked that ammonia soaps are also more soluble than soda soaps.

As to the comparative effect of equivalent amounts of caustic and carbonated alkali, in the former case the action will proceed till the usual hydrolysis equilibrium of soap solution is reached. In the latter the action is arrested when equilibrium with bi-carbonate is reached and can only approach equality with the equivalent quantity of caustic alkali in solutions hot enough to expel all the carbon dioxide.

VII.—The Function of Soap in Milling.

As regards the soap milling process, Harrison's conclusion (private report to the Association) that the hydrolysis alkali from the soap is the real milling agent, is further supported by the present determinations of the sorption of caustic soda from soap by wool. In view of the fact that acetic acid effects very inferior milling as compared with caustic soda alone, it is unlikely that the much weaker fatty acid liberated from soap contributes at all to the milling action. It would thus appear that the liberated fatty acid exerts only secondary functions in controlling the extent of sorption of caustic soda from the soap, in preserving the handle of the material, and in acting as a lubricant. The relative "causticity" of alkaline solutions (see pp. 136-137) should thus be of interest in connection with other possible substitutes for soap in milling.

SUMMARY

The present work deals primarily with the sorption of soap from aqueous solutions by wool. The results obtained are as follows:—

(1) The basic portion of the soap (*i.e.*, the alkali) is sorbed much more than the acid portion (*i.e.*, the fatty acid) so that the solution becomes charged with excess of fatty acid.

(2) The loss of fatty acid by the solution appears to take place in two ways—(*a*) by the sorption of actual soap, (*b*) by the precipitation on the wool fibre of some of the freed fatty acid present as the result of the preferential sorption of caustic soda.

(3) In the case of dilute solutions, this precipitation is the main cause of the loss of fatty acid by the solution.

(4) The diminution of this precipitation with increase of concentration of the solution is due to the " protective colloid " action of the soap, and with strong solutions the main cause of the loss of fatty acid is therefore sorption of actual soap.

(5) The process of sorption proceeds for several hours without sign of equilibrium, and is greatly accelerated by rise of temperature.

(6) During the initial stages of the contact between the wool and solution, the rate of loss of alkali is very much greater than the rate of loss of fatty acid, but this difference lessens with time, and, after prolonged contact, the two rates appear to become roughly equal.

(7) This mode of variation between the two rates of loss is to be expected *a priori*, whether it is assumed that the loss of fatty acid is due to precipitation of fatty acid as a secondary action following the sorption of alkali, or to sorption of actual soap.

(8) With mixtures of soaps from oleic and palmitic acids, there is a preferential sorption of the oleic acid.

(9) Potassium and sodium oleates do not differ in any marked manner with respect to the sorption of either alkali or fatty acid.

(10) The sorption of alkali from a chemically neutral soap solution is equal to that from a solution of caustic alkali of very much smaller concentration. This suggests a method of measuring the " effective alkalinity " of chemically neutral soaps and other salts, such as carbonate and borate of soda, which are alkaline in aqueous solution.

(11) The ratio of the concentration of caustic alkali to that of the solution of soap giving the same alkali sorption decreases with increase of concentration of soap. (This is to be expected on the theory of hydrolytic dissociation).

(12) The known advantage of free alkali (carbonate) has been attributed by previous workers to its physical action in increasing emulsification, but it is obvious that in the case of wool scouring it has an important chemical function in opposing the liberation of fatty acid.

The bearing of these results on a number of practical points is discussed.

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A STANDARD METHOD FOR THE ESTIMATION OF SOAP IN WOOL.

(*Contributed by the* British Research Association for the Woollen and Worsted Industries.)

It was shown in the Interim Report, Publication No. 11, of the above-named Association, that residual soap insufficiently washed out is often the cause of trouble in dyeing and finishing. Estimation of the soap is necessary, therefore, in the study of faults due to this cause, as well as for the study of methods of scouring and washing off.

On attempting analyses by the usual methods, however, it was soon found that the results were irregular and difficult to explain. As a result, and before further work could be undertaken, an effort had to be made to devise a satisfactory method of analysis.

It is shown below that absolute alcohol is a satisfactory solvent for the extraction of soap from wool. It was found, however, that it was not possible to recover from the wool the same amount of soap as was originally placed there.

The effect of carbon dioxide in the air on soap on wool is to form sodium carbonate or potassium carbonate and an " acid soap," and there is distinct evidence also to show that some of the alkali from the soap is absorbed or combined with the wool substance itself, leaving fatty acid on the fibre.

Both these causes, namely, carbon dioxide in the air, and absorption of alkali by the wool, destroy the soap as such, leaving acid soap or fatty acid. The result is that analysis finds on the wool a mixture of soap, free fatty acid (or acid soap), and alkali carbonate, and there is a discrepancy of alkali which has disappeared, leading to the conclusion that the wool has extracted and combined with the alkali of the soap. This question is dealt with in another paper, and is of some importance in connection with scouring and washing off and with the effect of alkalinity in soap.

Analysis of woollen material for soap can therefore only give a result which shows the amount of soap actually present as such. Changes may take place during storage, and will be recorded; therefore estimations of soap as a check on the scouring process should be made on cloth dried out of contact with carbon dioxide, or at any rate with as little exposure to the atmosphere as possible.

Analyses of " finished " material will give results which are ambiguous unless the previous history of the material is well known, *i.e.*, part of the soap may be returned as oil, whereas the latter is really produced by decomposition of the soap.

That the matter is of importance to the analyst may be judged from the fact that the Association has had before it widely differing analyses by different analysts of soap in the same material.

From the foregoing general summary, we may now proceed to the details of the method, which will be of interest principally to dyers and analysts.

PREVIOUS METHODS.

Hummel (" Organic Analysis "—Allen, VIII, 682) says:—For raw wool, extract with ether and remove soluble oleates by shaking the ether with water. The residual wool is repeatedly washed with cold distilled water; this extract is added to the water separated from the ether. The wool is washed with alcohol and the oleates thus dissolved are added to the aqueous solution. The soluble oleates are determined in this solution. The wool is then treated with dilute hydrochloric acid to split up earthy oleates, washed to remove the acid, dried, and treated in succession with ether and alcohol. From these solvents, on evaporation, oleic acid is obtained corresponding to the earthy oleates.

Maercker & Schulz ("Methods of Textile Chemistry"—Dannerth, p.60) use the same method.

Woodmansey (Jl. S. Dyers and Col., 1919, p.169) first extracts the wool with petroleum ether to remove oil and fat. This is followed by immersion in a boiling solution 1% by volume of hydrochloric acid, squeezing, and air drying. The liberated fatty acids are extracted by ether or petroleum ether, and are taken to represent the soap.

Hummel's method is long and tedious and, therefore, liable to inaccuracy when dealing with small percentages, and in the presence of oils and free fatty acids the effect of the solvents is altered—*e.g.*, earthy oleates become soluble in ether.

When employing Woodmansey's method, it is necessary to examine the residue from the first petroleum ether extraction, because we find notable quantities of soap removed as well as oil and fat.

In one case, we obtained 0·48% soap as sodium oleate by petroleum ether extraction from a sample of slubbing oiled with oleine. This is reasonable because acid soaps are soluble in petroleum ether, and soap plus oleine gives an acid soap. But even when neutral soap is used, it may decompose, forming acid soap as is shown later.

In another case, a scoured worsted cloth on extraction with petroleum ether gave 0·012% sodium oleate and, when the same material had 1·015% soap added, the petroleum ether removed 0·21% sodium oleate. Titration of the petroleum ether extract in alcoholic solution with N/10 hydrochloric acid is therefore necessary to estimate the soap soluble in petroleum ether. Further, even allowing for the above, the estimation of the fatty acids by Woodmansey's method does not give a true representation of the soap present on the cloth (see below).

METHOD OF ANALYSIS.

It is found that extraction with absolute alcohol gives excellent results, using certain precautions. The alcohol must be re-distilled and neutral. The material for analysis is placed in a soxhlet extractor of 200cc capacity. Twenty-six grams of 9 oz. worsted cloth or 10 grams worsted sliver or top were used. All the operations must take place in glass vessels without corks.

Effect of Cork on Extractions.—An extraction apparatus, having a cork $\frac{5}{8}''$ diameter, and run for three hours with absolute alcohol, dissolved 0·0104 grams from the cork; with petroleum ether, it dissolved 0·0008 grams. Consequently, glass apparatus with ground-in joints must be used. The alcohol is also distilled off afterwards from a flask having a ground-in connection for the tube leading to the condenser.

Temperature.—It is necessary to maintain the temperature of the alcohol and wool in the extractor at or near boiling point. To secure this, the extractor is covered with asbestos paper or tape.

Duration of Extraction.—Almost complete extraction of the soap is obtained by filling and emptying the extractor 12 times with hot liquor: the time taken is 5—6 hours. In one case, 12 extractions gave 1·14% total extract, and a further 12 extractions gave only 0·074% extract. For ordinary analysis, 12 extractions are sufficient.

Treatment of the Solution.—The solvent is filtered hot before evaporation through a thin Swedish filter paper No.1F. The bulk of the alcohol is distilled off, leaving about 50cc. This is poured into a wide-mouthed flask of 100cc. capacity, and the distilling flask is washed into the same. The alcohol is then evaporated to dryness on a water bath, and the residue dried in the steam oven, cooled in a desiccator under diminished pressure, and weighed until constant. This gives the total alcohol extract.

The extract is boiled with 60cc. distilled water, methyl orange or methyl red being added. At first, this was titrated hot with N/10 hydrochloric acid. The acid used was calculated to sodium oleate, but this method was found unsatisfactory.

A known excess of N/10 hydrochloric acid* is then run in (25—30cc.) boiled, allowed to cool, and shaken out with ether three times. The ether must be neutral, and is made so by redistilling over lime. The ether is washed with water and the washings added to the liquor. On evaporation, the ether gives the total oil and fatty acid in the alcohol extract.

Fatty Acid.—Dissolve the oil thus obtained in absolute alcohol and titrate with N/10 caustic potash or soda and phenol phthalein. This is calculated to sodium oleate in the experiments detailed later, but in a sample of unknown composition would include fatty acid or olein present as such.

Soap.—The residual liquor after shaking with ether is titrated back with N/10 caustic potash and the difference between added acid and back titration is calculated to sodium oleate. This back titration gives the most accurate results because the whole of the soap is only decomposed on boiling with excess acid.

Calcium.—The calcium soaps are included above as sodium oleate, but may be determined as follows:—The liquor after shaking with ether and back titration for soap is evaporated to dryness, washed with a little ether and dissolved in water. Ammonia, ammonium chloride and ammonium oxalate are added and allowed to stand for several hours. The precipitate is filtered, washed and dissolved in warm 2% sulphuric acid, then titrated hot with N/10 potassium permanganate. From this the amount of calcium is calculated and expressed as calcium oleate (or sodium oleate).

With one set of extractions 0·09% calcium soap was obtained.

It frequently happens that a persistent emulsion forms when shaking out with ether. It is then advisable to separate as much ether as possible, evaporate the acid liquor to dryness, and wash the residue with ether to remove fatty acid or oil. In some cases, the amount of fatty matter in this emulsion amounts to 0·03% on the weight of the cloth.

VERIFICATION OF ANALYTICAL METHODS.

(A) 26 grams of scoured worsted cloth were carefully extracted with petroleum ether and alcohol and impregnated with 1·015% soap (neutral and made from purified oleic acid) in solution in dilute alcohol.

(B) 26 grams of the same cloth unextracted were impregnated with 1·015% soap as in A.

B therefore contained the original soap and grease on the cloth plus 1·015% neutral soap.

On analysis A gave 0·99% fatty acids (as sodium oleate) and
0·88% alkali (as sodium oleate).
B gave 1·51% fatty acids (as sodium oleate) and
0·95% alkali (as sodium oleate).

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*N/10 sulphuric acid is preferable as it is less soluble in ether and there is less danger of loss on boiling.

The original soap and fat on the cloth was separately determined, viz.:
0·42% fatty acid (as sodium oleate)
0·23% alkali (as sodium oleate).

By subtraction, the added soap on B gives
1·09% fatty acid (as sodium oleate)
0·72% alkali (as sodium oleate).

The object of this experiment was to find out if soap added to a commercially scoured cloth could be recovered entirely. There is, as is seen, a loss in alkali in both A and B, but the fatty acid of the soap is recovered (within experimental error).

Further samples of unextracted cloth were impregnated with 1·015% soap (C) and with 2·03% soap (D).

On analysis, the following results were obtained:—
(C) Fatty acids 1·43% (as sodium oleate) alkali 0·90% (as sodium oleate)
(D) Fatty acids 2·50% (as sodium oleate) alkali 1·60% (as sodium oleate)

Difference... 1·07% Difference... 0·70%

The fatty acid totals are in good agreement with the amounts of soap added, but the amount of alkali is always less than expected. After a large series of analyses the conclusion has therefore been reached that with sodium oleate " neutral " wool absorbs or combines with part of the alkali, leaving an excess of fatty acid on the surface; or, the soap is decomposed into carbonate and fatty acid by the carbon dioxide in the air. This fact seems to be borne out by the ready solubility of a portion of the soap in petroleum ether.

Effect of Carbon Dioxide.—The experiment was repeated with a more rigorous exclusion of carbon dioxide. The whole impregnation of the cloth with soap solution and the drying of the same was completed in vacuo (740mm). The only possible exposure to air was in transferring to the extraction apparatus—less than 30 seconds. The result was more convincing than ever that there is a loss of alkali.

The original soap on analysis proved to contain
Fatty acid reckoned as sodium oleate 100%
Alkali ,, ,, ,, 104·7%

That there appeared to be a slight excess of fatty acid may be explained by the fact that the molecular weight of the fatty acid was not exactly the theoretical for oleic acid; but the soap and decomposed soap from the cloth proved to contain
Fatty acid reckoned as sodium oleate 100%
Alkali acid reckoned as sodium oleate 68·7%

Thus, the apparent change in amount of alkali due to the action of the cloth was from 104·7% to 68·7%.

An incomplete extraction of the cloth with warm water after the extraction with alcohol showed a definite amount of alkali, viz., 0·3% (as sodium oleate) of the weight of the cloth. It is clear that alkali is removed from soap and retained by the wool in a form resistant to alcohol extraction, possibly in a loose combination.

The cloth used for this test had been extracted four times with alcohol, boiled, and well washed with distilled water before impregnating with soap.

In this experiment the soap solution was in contact with the cloth for over 24 hours on account of the slowness in drying, so that there was more opportunity for some reaction to take place between the wool and the soap solution.

The whole question of the sorption of the alkali and fatty constituents of soap by wool is considered in another paper, published simultaneously.

COMMERCIAL SAMPLES.

Two pieces of 9 oz. worsted cloth were scoured in a washer, using a dilute solution of oleic acid-soda soap and soda-ash. The liquors were maintained alkaline with soda-ash and ammonia, during the first part of the washing off, and only finally rinsed in clean water, so that the best conditions for removal of the soap were adhered to. Analysis by the above method gave

(1) Fatty acid 0·72% as sodium oleate, alkali 0·39% (sodium oleate)
(2) Fatty acid 0·45% as sodium oleate, alkali 0·33% (sodium oleate)

In each case the alkali is less than the amount corresponding to the fatty acid, thus showing that a partial acid soap is formed in spite of the fact that the washing liquors were kept alkaline till nearly the end.

Another case.—In the course of experiments now in progress on methods of scouring, 40 yards of flannel (oiled with 8—10% commercial, 98% olein, and weighing 11½lbs.) were scoured with special care as regards the quantities of alkali used and washing off, etc.

For the alcoholic extraction, 640 grams of the scoured flannel were used, extracted in six portions, and the extracts were united and examined as a whole. Analysis of the extract gave the following result:—

Total extract 0·688%.
Fatty acid (as sodium oleate) 0·412%.
Calcium (trace).
Unsaponifiable 0·257 (mainly wool wax products).
Saponifiable 0·418.
Sodium (as sodium oleate) 0·243%.

The relation of fatty acids to sodium is therefore 0·412 : 0·243.

The discrepancy is all the more striking in this case because experimental errors have been reduced to a minimum owing to the larger quantity of cloth used.

Extraction with water.—After extracting with alcohol, 53·5 grams of the flannel were washed first with hot distilled water and then with cold. Titration of the aqueous extract with methyl red gave 0·21% alkali expressed as sodium oleate; thus slightly more than the missing alkali is accounted for.

The total alkali is 0·243% + 0·21% = 0·453%.
The total fatty acid is ... ... 0·412%.

This experiment shows that although fatty acid has been converted into soap on the cloth, by using a large excess of alkali, yet the wool retains a portion of the fatty acid as an " acid " soap and a portion of the alkali remains as such, probably partly as carbonate, as the cloth had been exposed to the air for some days after scouring. This is exactly in conformity with the other experiments. Further investigation on the mode of combination of the alkali remaining on the wool is being made.

Potash Soaps.—A potash olein soap was made by accurately neutralising oleic acid with caustic potash. Worsted cloth previously extracted with alcohol was impregnated with 1% real soap in dilute alcoholic solution, allowed to dry, and extracted with absolute alcohol for 5—6 hours. The result was as follows:—

Total extract	1·19%
,, fat	1·00%
Fatty acid as oleic acid	1·03%
,, ,, potassium oleate	1·17%
Potassium as potassium oleate	0·99%

It will be seen from the above results that the whole of the soap has been recovered and that there is a slight discrepancy in the amount of alkali. The figure 0·99% as potassium oleate should equal 1·17% ; there is, therefore, a loss of 0·18% alkali. This is in agreement with the other analyses, but the loss of alkali is less.

Effect of Carbon Dioxide.—Another investigation was made in which the cloth, after impregnating with potassium oleate, was purposely exposed to the air of the laboratory for 18 hours so that the action of carbon dioxide in the air could take place. The result was—

1% potassium oleate applied to the cloth.
Total extract 1·02%.
Total fat 0·84%.
Fatty acid as potassium oleate 1·05%.
Potassium as potassium oleate 0·72%.

There is thus a difference of 0·33% potassium oleate on the alkali estimation.

Sodium Palmitate.—In order to test the accuracy of the method for hard soaps, a piece of extracted cloth was impregnated with a dilute alcoholic solution of sodium palmitate made by neutralising a good sample of commercial palmitic acid (molecular weight 261·3 probably contains some stearic acid) ; 1% sodium palmitate was put on to a sample of worsted cloth which had been previously extracted to free it from soap or oil.

Yields on analysis:—

Total extract	0·98%
,, fat	0·85%
,, fatty acid as palmitic..................	0·85%
,, ,, sodium palmitate	0·93%
Sodium as sodium palmitate.................	0·95%

In this case the alkali is in agreement with the fatty acid and there does not appear to be any perceptible loss of alkali. It is possible that the soap crystallised on the fibre as it is very insoluble, and thus contact with the fibre was not complete.

PRACTICAL USE OF THE ANALYTICAL METHOD.

When an unknown sample is submitted for analysis it is first necessary to extract with freshly-distilled petroleum ether, to remove oil as such. This oil should then be examined for presence of soap by boiling in distilled water and titrating with N/10 hydrochloric acid. The cloth is afterwards extracted with alcohol to remove the remaining soap as described.

It may happen that dyed material will present some difficulties on account of the loose colour extracted. In such cases, the end point of the titration is difficult to determine, but this can usually be got over by suitable dilution and by adding a slight excess of the indicator. The presence of sodium carbonate does not affect the results as it is insoluble in petroleum ether.

A more accurate control of the scouring operation will be effected if estimations of the amount of soap remaining in the cloth or wool be performed periodically, and this should materially assist the manufacturer in obtaining a more regular " finish " and " handle " and at the same time will be of considerable assistance to the dyer.

An investigation is being made of the effect on the rate of absorption of dyestuffs of varying amounts of soap (or, what amounts to much the same thing, fatty acid) on wool material. Preliminary results show that this is an important factor.

NOTE: CAUSE OF LOSS OF ALKALI FROM SOAP ON WOOL.

As the reason for the loss of alkali from soap in contact with wool is somewhat obscure, experiments were made to ascertain if there is any possibility of a reaction between soap and alcohol. It was thought that possibly some sodium alcoholate might be formed, which, by oxidation, would form sodium acetate and thus account for the discrepancy.

The experiments were as follows:—

(1) 1 gram sodium oleate dissolved in 250cc alcohol; 1·5cc distilled water added (equivalent to the water in the wool used in our experiments) and dry air passed through for several hours.

(2) 50cc of the above solution boiled 3 hours.

(3) 50cc evaporated to dryness in a 100cc flask as used in our experiments.

In none of the cases was there any loss of alkali.

It is known that a solution of soap in water is decomposed by carbon dioxide into alkali carbonate and free fatty acid (Third Report Coll. Chem. p.6). This readily takes place in a 1% solution of either sodium or potassium oleate; a precipitate forms and the soap solution loses its lathering power.

Such a solution on extraction with ether yielded 91·1% of fatty acid, and the whole of the alkali was retained in the aqueous portion. With a view to testing further the effect of CO_2, a pattern of purified cloth was treated with 1% sodium oleate dissolved in aqueous alcohol, and dried out of contact with air, with the following result:—

Total extract	1·09%
Fatty acid (as sodium oleate)..............	1·06%
Alkali (as sodium oleate)......................	0·96%

There is a discrepany of 0·1% which cannot be due to formation of sodium carbonate.

In another experiment, the air-dried impregnated cloth was left for several hours in carbon dioxide gas, and a much more marked loss occurred.

1% soap on the weight of cloth was added

Total extract	1·02%
Fatty acid (as sodium oleate)..............	1·05%
Alkali (as sodium oleate)......................	0·78%

The difference was 0·27%, which is considerable.

Miss Thompson (chemical assistant) has carried out much of the work of extractions and analyses.

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A MICROLOGICAL STUDY OF THE FLEECE OF THE BLACKFACE LAMB.

By F. A. E. Crew and Janet S. S. Blyth.

(Paper from the Animal Breeding Research Department, University of Edinburgh, by arrangement with the British Research Association for the Woollen and Worsted Industries).

A number of skins of Blackface lambs which were either still-born or had died shortly after birth were sent to this Department by Lt.-Col. T. W. Cuthbert, of Achindunie, J. J. Macmillan, Esq., of Glencrosh, and Capt. John Stirling, of Muir of Ord, to whom we are much indebted.

Of the dozen or so of skins received, no two were alike either in texture or in the regional distribution of black; it was impossible, therefore, to choose any one and describe its characters as typical of the Blackface lamb fleece. Two were chosen representative of the two extreme types: one (Fig. 1) seems to be composed mainly of stout, relatively straight, upstanding fibres; the other (Fig. 2) was the softest in texture, the most curly, and seemingly the thinnest.

Fibres from both these fleeces were examined microscopically in great numbers. They were washed in ether; some were then stained with picric acid and mounted either dry or in balsam in xylol.

Ultimately, it became obvious that in each fleece there were three sorts of fibre (hereafter referred to as types A, B, and C) and that the two fleeces differed one from the other because of differences in the character of the growth of certain of these fibres.

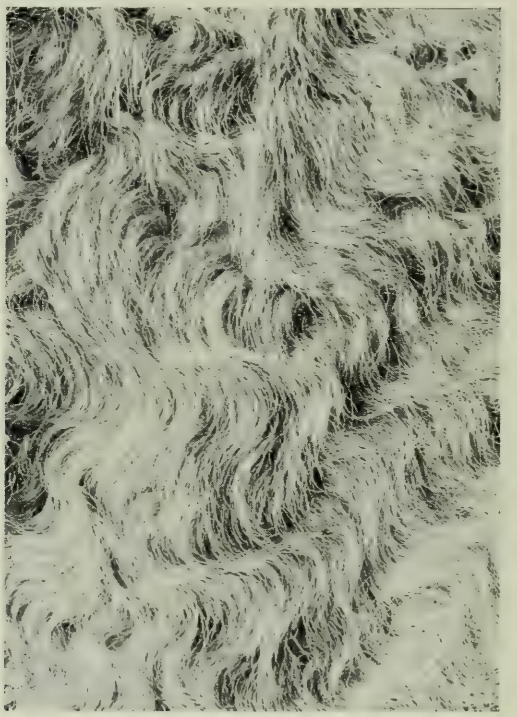


Fig. 1.

Fleece I; ×2/3; (Mid-shoulder region).

Type A. fibre.—The proximal end of the fibre, under the microscope, has the structure of a typical hair (Fig. 3). Examined dry with surface lighting, the whole surface of the fibre is seen to be occupied by a mosaic of four- and five-sided cells. When mounted in oil and examined with transmitted light, the picture changes. The centre of the fibre, formerly filled with air, now clears and bubbles of air can be driven from the cut end of the fibre or from a rupture along its length; by careful focussing, a narrow clear border can be made out, and, on this, faint transverse markings can be recognised. Within this narrow border the central portion shows up as a mosaic similar to that seen when the fibre is examined dry.

On cross-section, the portion of the fibre presents three distinct areas—cuticle, cortex, and medulla (Fig. 3a). The cuticle consists of an apparently single layer of overlapping scale-like cells, some of which show a free edge clearly raised from the general surface of the hair. This ring merges into a narrow clear band, which, however, is much wider than the first. Finally, the central portion showing reticular structure is seen taking up the largest part of the hair calibre.

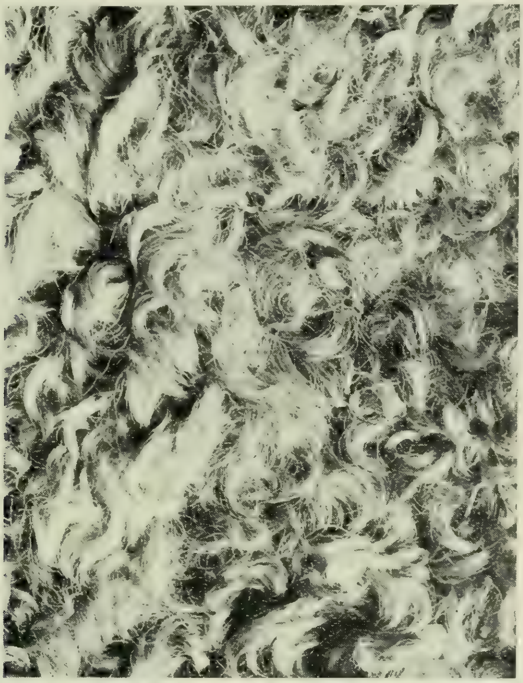


FIG. 2.

Fleece II; ×2/3; (Mid-shoulder region).

After a short distance the structure changes. The surface markings no longer present a mosaic appearance but pass irregularly from the lateral border to lateral border and where they meet the border notched projections break the outline (Fig. 4). When mounted in oil, three areas can be distinguished: A central air-containing core of irregular size and finely reticular appearance; a faintly longitudinally striated intermediate area which distally gradually becomes the largest of the three, at the expense of the central part; and a thin translucent area consisting of flat scale-like cells with projecting edges pointing to the tip of the fibre.

Here the cross-section shows the same three areas as the first (Fig. 4a). The cuticular scales, however, have become more obvious, and the cortex wider, while the medulla has decreased in size and its cellular markings are now scarcely visible.

Nearing the tip, the features of the fibre change once more. The characters pass gradually into those of typical wool (Fig. 5). The central area becomes fragmental and finally comes to an end as the fibre tapers to a fine tip. The cross-section (Fig. 5a) shows that the medulla has completely disappeared and the entire central portion is taken up by cortex.

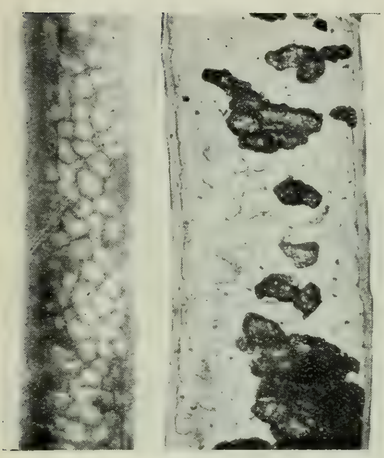


FIG. 3.
A-type fibre, proximal portion, ×200 (left : in air with direct lighting ; right : in oil with transmitted light).

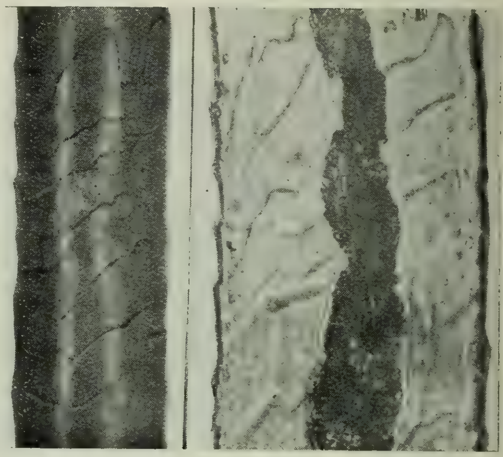


FIG. 4.
A-type fibre, intermediate portion, ×570, in air and in oil.

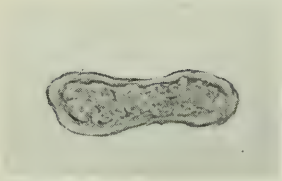


FIG. 3A.
Cross-section of above in oil, ×200.

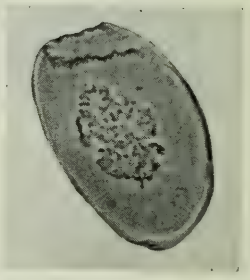


FIG. 4A.
Cross-section of above in oil, ×570.

Type B fibre.—The proximal portion of the fibre has characters similar to those of the intermediate portion of the A-type fibre, while the distal portion is similar to the distal portion of the A. fibre (Figs. 6, 6a, 7, 7a).

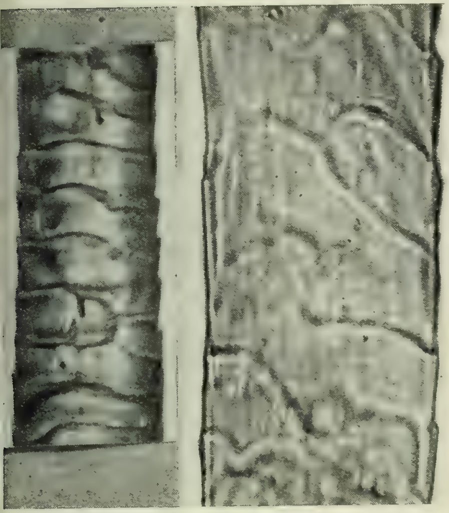


FIG. 5.
A-type fibre, distal portion, ×875, in air and in oil.

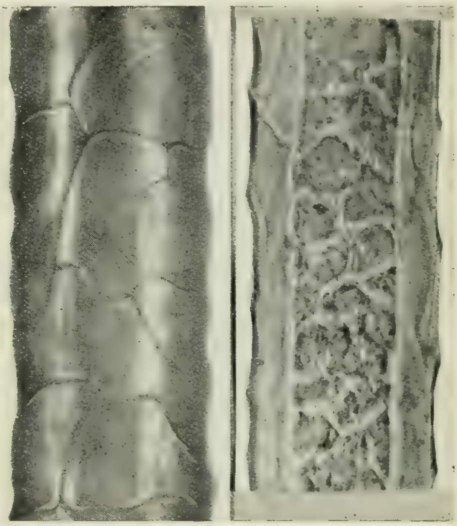


FIG. 6.
B-type fibre, proximal portion, ×570, in air and in oil.

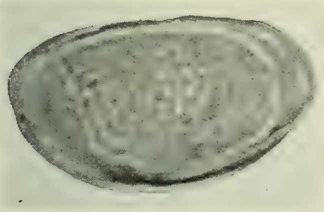


FIG. 5A.
Cross-section of above, in oil, ×875.

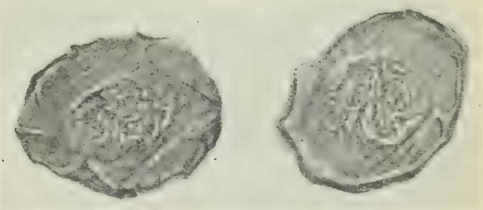


FIG. 6A.
Cross-section of above in oil, ×570.

Type C fibre.—From root to tip this fibre presents features which are similar to those of the distal portion of the A-type fibre (Figs. 8, 8a). In the coarser of these fibres, very fine discontinuous fragmental medulla can be seen.

TABLE 1.

Number of Fibres per 1/8 sq. inch. (Sample from mid-shoulder region).

	Type A and B.	Type C.	% of C.
Fleece I.	1703	1809	63.0 %
Fleece II.	1142	2080	59.6 %

or,

Fleece I.	23,056 Fibres per sq. inch.
Fleece II.	25,776 ,, ,, ,,

TABLE 2.

	Fleece I.			Fleece II.		
	Type A.	B.	C.	A.	B.	C.
Average length of fibre	2″	1.02″	0.302″	1.63″	1.28″	0.378″
Average Number of waves per fibre	2	1	3.25	2	1	2.58
Average ,, ,, ,, inch	1	1	10.7	1	1	6.8
Greatest number of waves per inch	1	1	11.4	1	1	9.4
Longest fibre	2″	1.12″	0.5″	1.75″	1.60″	0.5″
Shortest fibre	—	0.94″	0.2″	—	1.0″	0.2″

TABLE 3.

Average Diameters.

	Fleece I.	Fleece II.
Type A.	0.0043″	0.0021″
Type B.	0.00135″	0.00147″
Type C.	0.00061″	0.00053″

To the naked eye, the only difference between the A and B fibres in Fleece II is that the A-type is somewhat thicker, but in Fleece I the A fibres are also longer than the B-type. The A fibres of Fleece I are stouter than those of Fleece II, there is no appreciable difference in the thickness of the B fibres from the two fleeces. The C fibres are similar in the two fleeces and are much shorter and finer than the other two types; also, they exhibit crimpiness or waviness. In diameter, they compare favourably with typical commercial wool of excellent quality and actually are finer than some fibres taken from a sample of Merino fleece. The C fibre further differs from the other two in that its diameter is uniform along the greater part of its length and the fibre only begins to taper at a very short distance from the tip whereas in the A and B fibres the diameter gradually becomes less and less from near the root to the tip.

In Fleece I, the A and B fibres are but weakly waved and exhibit little or no tendency to form staples. These fibres in Fleece II, on the other hand, are much more curly and form very definite locks. It is this difference in the character of the growth of the A and B fibres which is responsible for the difference in the general appearance of the two fleeces. The C-type fibres yield nothing to the appearance of the fleece, being in both cases completely hidden by the longer and straighter A and B fibres.

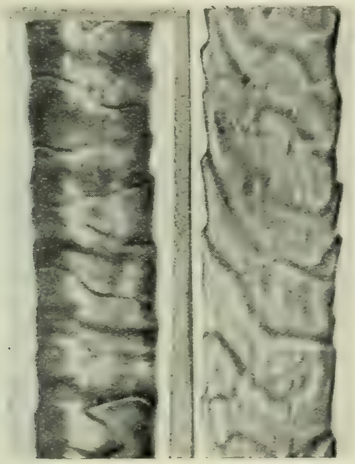


FIG. 7.
B-type fibre, distal portion, ×875, in air and in oil.

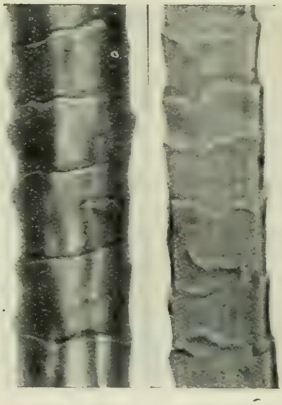


FIG. 8.
C-type fibre, ×875, in air and in oil.

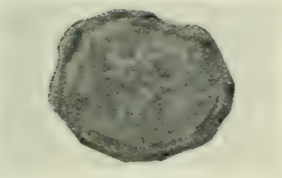


FIG. 7A.
Cross-section of above, in oil, ×875.

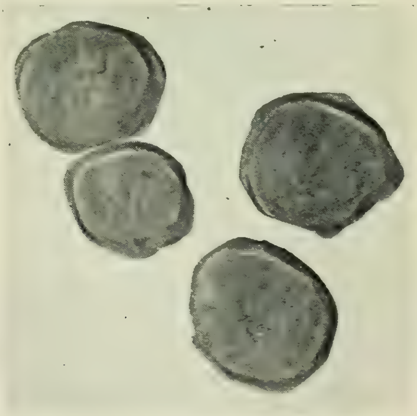


FIG. 8A.
Cross-section of above in oil, ×875.

From Table 1, it is seen that the C-type fibre, *i.e.*, the true wool, forms numerically more than half of the fleece, and that their proportion is slightly greater in Fleece I than in Fleece II. It is also to be noted that though Fleece I appears to be the thicker, yet the actual number of fibres is greater in Fleece II.

Finally, a search was made for scattered black (grey) fibres in the two fleeces. A few grey patches were found scattered throughout both fleeces. They consist of all the three types of fibre and vary in size.

We wish to express our thanks to Professor J. Cossar Ewart, University of Edinburgh, for much helpful criticism and advice in this study.

SUMMARY.

In the fleece of the Blackface lamb three sorts of fibres were found. One, in its proximal portion has the characters of typical hair, at its tip the characters of typical wool, while the middle part appears to have a structure intermediate between hair and wool. The second sort of fibre has the structure of wool near its tip and the proximal portion has a structure similar to the middle portion of the fibre of the first kind. The third fibre has the structure of wool from root to tip.

Among the dozen fleeces examined there was considerable variation, and this was found to be due to differences in the character of growth of the first two sorts of fibres. The third type contributed nothing to the appearance of the fleece. The scattered grey fibres met with in the Blackface fleece were found to belong to all the three types.

The fibres having the microscopical structure of wool constituted more than half of the fleece and compared very favourably with wool of recognised commercial value.

[Received for publication, 5th June, 1922.

WOOL FIBRE MEASUREMENT.

By H. S. Holden, D.Sc., University College, Nottingham.

From time to time, considerable attention has been given to the subject of wool fibre measurements with the object of finding some connection between the quality number and the diameter of the fibre. Of late, the subject has come once more into prominence in connection with the observed tendency for wools to become coarser in quality than their quality number formerly indicated. Exact measurements should have the result of providing some basis for establishing a standard thickness of fibre for each class and of indicating the limits of variation for any particular quality number. This should be useful in the examination of tops as showing whether, in general, these are of the quality indicated and as revealing the extent of admixture of coarser fibres in the blend. Measurements have been made on a series of quality numbers as follows:—80, 70, 64, 60, 58, 56, 54, 50, 48, 46, 40 and 36, the quality being taken from samples used as commercial standards. The results given herewith represent the diameter measurements of forty fibres of each quality number, five measurements of each fibre being taken, which gives two hundred measurements in all for each quality. The fibres were mounted in Canada balsam and the middle portion of each was selected for investigation. The apparatus used was an eyepiece micrometer made by the Spencer Lens Co. in conjunction with 1/6″ Spencer objective. This particular eyepiece has the advantage of being capable of rotation in the microscope barrel and so facilitating the alignment of the micro-scale and fibre.

In taking the measurements, the following precautions were observed:

(1) Only those parts of the fibre showing parallel edges were used, irregular bulgings and depressions being ignored.

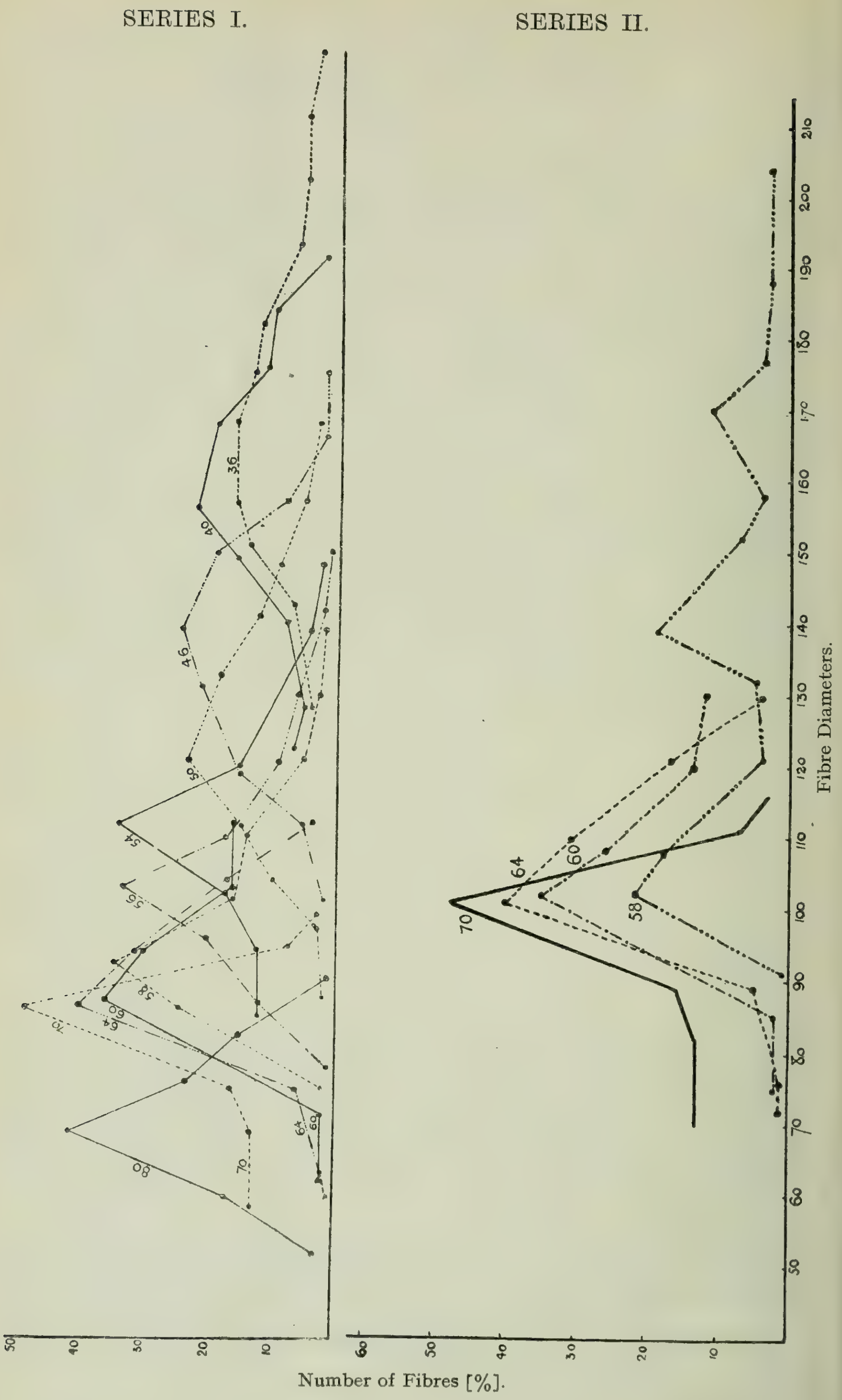
(2) Measurements were taken only when the two edges of the fibre were in absolutely crisp focus at the same time. The results obtained were grouped in ranges of ten, and the average of each group taken. The points so produced were plotted and are shown herewith in Series I.

If the curves of the various quality numbers be examined (Series I), it will be noted that the curves, in general, are unimodal. From 80's downwards there is an increasing tendency for the curve to flatten, and there is also an ever-increasing range of diameter as the coarser qualities are reached. When the quality sample varies greatly in diameter, the curve appears bimodal or trimodal as shown in the comparison in Series II where 58's quality is shown to be very variable in comparison with 70's and 64's.

A mixture of fibres of varying quality numbers could be made which would give an average of the correct type, but this would be at once revealed as a mixture when plotted as a single curve, since it would show:

(*a*) A bimodal or trimodal character.

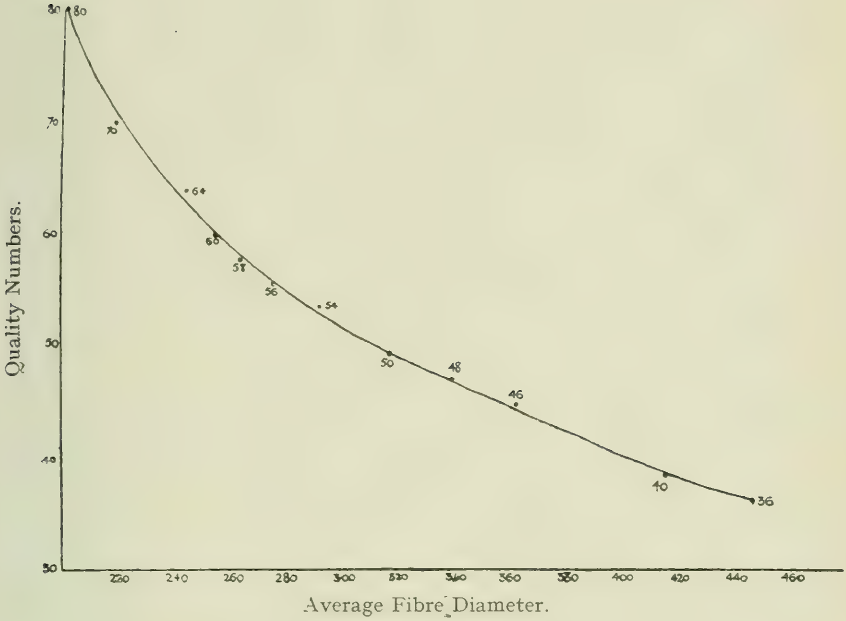
(*b*) An inordinately broad base.



SERIES I.

SERIES II.

SERIES III.



The following table gives the average diameter in millimeters obtained for each quality number:

Quality number.	Millimeters.
80's	·0201
70's	·0219
64's	·0245
60's	·0256
58's	·0266
56's	·0278
54's	·0294
50's	·0320
48's	·0343
46's	·0366
40's	·0420
36's	·0452

These results will be found plotted in Series III giving the curve from fine to coarse quality. As a result of those measurements, it would seem that a basis exists for a standard of fibre thicknesses which will correspond to quality numbers and this affords some indication of the approximate diameter to which each quality in the range should be expected to conform.

(Received for publication, 5th July, 1922).

A STUDY OF FLAX AND KINDRED FIBRES†

I.—SOME OBSERVATIONS ON THE BEHAVIOUR AND STRUCTURE OF TEXTILE FIBRES, WITH AN ACCOUNT OF A CONVENIENT METHOD OF DISTINGUISHING FLAX FROM HEMP.

By C. R. Nodder, B.A. (The Linen Industry Research Association).

During the course of an investigation of the effect of pressure upon textile fibres it was noticed that the striations observable in the cell-wall of flax and ramie always formed left-handed spirals, whereas those in the case of hemp and jute always formed right-handed spirals.* Further, it was found that if a wet fibre is held with the free end towards one, flax and ramie are always seen to twist in a clockwise direction when drying while hemp and jute always twist in the reverse direction. This distinction forms the basis of a valuable naked-eye test for distinguishing between flax and hemp. Apart from this incidental result the investigation referred to has led to the possibility of explaining several of the characteristic phenomena presented by textile fibres when the spiral structure of these is considered in conjunction with certain of the chemical or physico-chemical properties of cellulose.

TO DISTINGUISH BETWEEN FLAX AND HEMP FIBRES BY OBSERVING THE DIRECTION OF TWISTING ON DRYING.

The examination of hundreds of flax and hemp fibres has led to the conclusion that exceptions to the rule referred to above do not exist, or are extremely rare; no undoubted case of a reverse twist has in fact been observed. It has been found that the source or the stage in the manufacture of the material makes no difference in this respect; the fibres may be derived from freshly retted straw, from the raw scutched product or from green or bleached yarns or even from a beetled and finished cloth. As would be expected male and female hemp do not show any difference in the direction of twist under this test. This remarkable constancy in direction of twist recalls the interesting fact that hops always twine in a clockwise direction and scarlet runner beans (*Phaseolus*) in an anti-clockwise direction. Such phenomena are not uncommon in nature; thus the shells of snails and other univalve mollusca have, with very rare exceptions, always a right-handed twist and quite a number of similar facts might be cited.

The present-day tendency to prepare composite yarns of flax and hemp in various proportions brings about the necessity for a reliable test to place in the hands of those called upon to adjudicate in matters arising therefrom. It is believed that in these twisting properties is to be found a ready means of distinguishing, with certainty, between these two fibres at any stage of their manufacture.

The following suggestions may be found useful as regards the practical application of the test to the examination of mixtures. In the first place careful attention must be given to the method of sampling, since the presence of " pockets " of pure hemp or pure flax may otherwise lead to a wrong conclusion. Fibres must be chosen carefully from all parts of the material to be examined and this should be done systematically so that the fibres chosen come from places evenly distributed over the whole sample. In order to facilitate the teasing out of the fibres the material should, where possible, be cut into small pieces and soaked for some minutes in warm water. The use of a pair of fine-tipped forceps is recommended and a dark back-ground will save much eye-strain. In some cases a watchmaker's eyeglass may be found helpful. As far as possible single fibres should be examined and great care must be taken to make sure whether the movement observed is due to drying or to wetting. It is sometimes convenient to hold the thoroughly moistened fibre over a small iron sheet which is moderately heated by means of a low flame and then to observe the direction of the drying twist. The first movement observed on bringing a wet fibre into a warmer place is usually a slight twist in the " wet " direction but very soon the steady drying twist sets in. On wetting a dry fibre, it twists in the wet direction, often so rapidly that the movement is not readily observable. Although the appliances mentioned are desirable for systematic testing, none is, of course, essential. Its simplicity, its ready availability and its reliability, and the fact that the stage of manufacture of the sample is immaterial, should make the test of great value to the Trade.

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†Note.—*The following communication has been released by the Linen Industry Research Association for publication, and apart from a few minor changes is reproduced as originally issued for private circulation, as that Association's Research Institute Memoir No. 7, dated February, 1922.*

* When two or more main layers are visible this is true of the outer layer—the middle lamella is not taken into account.

The number of fibres that it is necessary to examine in order to be able to state the percentage of flax and hemp present in any particular sample, with a given degree of accuracy, varies with the proportions of the two components present. For most purposes, a hundred fibres should be quite sufficient if the sampling is properly done and, with practice, the examination of this number should take quite a short time. In a warm, dry room the fibres twist up rapidly as fast as they are removed with the forceps from the wet material, so that six or more can be examined in one minute. When the fibre has dried and twisted up, it reflects light in such a way as to appear dark and light in alternate sections. When the dry fibre is held in the right hand with its free end pointing to the left and rolled between finger and thumb in an anti-clockwise direction these dark sections appear to move towards the left in the case of flax (and ramie), and towards the right in the case of hemp (and jute). This may serve to confirm the direction of twist observed on drying which is occasionally difficult to see with unusually straight fibres.

As mentioned before, jute resembles hemp in showing an anti-clockwise drying movement and ramie resembles flax in showing a clockwise movement. Cotton fibres may twist in either direction and usually different parts of the same fibre twist in different directions; this behaviour may possibly be of use as a distinguishing test for this fibre. When any one of the above-mentioned fibres is stroked with a glass rod dipped in caustic soda solution of mercerising strength, a strong movement in the wet direction takes place; hemp, however, under this treatment often becomes irregularly contorted and assumes a woolly appearance, especially if the solution happens to be unevenly applied.

It is well known that " bast " fibres often show fine spiral striations in the cell-wall. Microscopic examination by the method described below showed that the striations in the outer layer of the cell-wall of flax and ramie always form left-handed spirals. In the case of hemp and jute the spirals were seen to be always right-handed, that is, the direction of twist is similar to that of the thread of an ordinary wood-screw. (A right-handed spiral as seen through a microscope still appears to be a right-handed spiral). The striations are an indication of the fibrillar structure of the fibre. It is clear, therefore, that with the fibres mentioned above, the movement on wetting or mercerising is accompanied by an *untwisting of the fibrils* which make up the outer layer of the cell-wall. The significance of this will be discussed later.

MICROSCOPIC EXAMINATION OF THE FIBRES UNDER CONSIDERATION.

Several methods are available for showing up the structure of vegetable fibres. The one that in the past has perhaps proved most useful is that of examining in polarised light after causing the fibre to swell up by treatment with soda of suitable strength. A method has been developed during the present work which is believed to have several advantages. The fibre to be examined is mounted in a strong calcium chloride solution which is tinted to a pale yellow-brown colour with iodine. While the fibre is being observed under moderately low magnification, pressure is exerted on the coverslip by means of the tip of a scalpel (for example), carefully avoiding any lateral movement. With care and practice the fibre may often be squeezed without breaking the coverslip until its width is increased as many as ten or fifteen times. The fibrillar structure is thus wonderfully displayed and the growth layers in the cell-wall become widely separated and very distinctly visible (see for example *Pl. II, fig. 10*, which represents a hemp fibre thus treated). The reason for the non-visibility of the fibrils unless the fibre has been treated in some way, as by swelling, is believed to be that they are so close together as to be beyond the resolving power of the microscope. The squeezing method here described, since it increases the width of the fibre, say ten times, brings the fibrils within the limits of visibility. The effect of the pressure is probably also to produce a certain amount of swelling of the individual fibrils on account of the occurrence of certain changes in the state of the cellulose. The occurrence of these changes is made manifest by the fact that the compressed part of the fibre stains a bright reddish purple, while the non-compressed parts remain a brownish yellow colour. This colour-change is a striking phenomenon, especially as observed in the case of ramie under low magnification; it illustrates in an interesting way the sensitiveness of cellulose to mechanical treatment. A change of the nature of depolymerisation is probably produced.

MICROSCOPIC CHARACTERS.

Flax: It has been known for some time that flax fibres often show markings which are more or less longitudinal and appear to be fissures in the cell-wall. These are particularly well seen in fibres mounted in the calcium chloride-iodine solution and on careful examination are seen to form parts of left-handed spirals (*Pl. I, fig. 1*). These fissures indicate the trend of the fibrils, since on compressing the fibre as described, they take up a more inclined position and are seen to run parallel with the fibrils which are thus brought into view. A flax fibre which has been compressed only moderately is shown in *Pl I, fig. 3.* The fibrils seen are broad compared with those finally brought out by more forcible compression. At this stage the flax fibre usually shows distinctly that it is made up of two main layers and, by careful focussing, it is possible to see that the inner layer is made up of fibrils lying in right-handed spirals. Further compression causes the appearance of extraordinarily numerous, extremely fine fibrils (*Pl. I, fig. 5*) and each of the two layers previously seen becomes separated into a number of lamellae, each with a fibrillar structure. In the case illustrated, which is a typical one, eight lamellae are seen in the outer group and three in the inner group. These lamellae are not sufficiently numerous to be explained as daily growth phenomena. Possibly their separation one from another may be correlated with a less than usually abundant deposition of cellulosic material on certain days owing, for instance, to lack of sunshine. It is hoped to test this view by examining fibres taken from a crop which has been grown under known meteorological conditions.

It is usually possible to observe with the naked eye the existence of two main layers in flax fibres when treated as described. Numerous transverse darkly staining lines (*Pl. I, figs. 3 and 5*) are also produced in the fibre layers by this treatment. These are due, in part, to the resistance to longitudinal extension experienced by the fibre and in part to pre-existing "dislocation marks." If a lateral or sliding movement is given to the coverslip, irregular folds (*Pl. I, fig. 5*) are produced in the cell membranes.

The dimensions of the finest fibrils which are shown up by the treatment here described deserve careful attention in view of the possible relationship of the fibrils to the cellulose molecules. If they exist in the uncompressed fibre their width is estimated to be of the order of 0.00003 mm., that is, a flax fibre with a diameter of 0.03 mm. (in the wet state) when compressed shows fibrils of which there are about one thousand lying side by side across the width of the fibre; they are thus, even in the compressed fibre, only just within the limits of microscopic visibility, it being remembered that the diameter of the fibre has been increased, from ten to fifteen times, by compressing.

It is natural to suppose that the chemical structure of the cellulose has a definite orientation with respect to the long axis of the fibrils. It is indeed not at all unlikely that the finest fibrils, of the dimensions indicated, are actually the cellulose molecules.* If this view is a correct one, the fibre must be regarded as, to all intents and purposes, a crystal, an idea which has recently found fairly general acceptance. The enormous tensile strength of individual textile fibres, which has been shown to be sometimes greater than that of wrought iron, is probably connected with this crystal-like structure. One is given the impression that the striations made evident by the compression treatment here described are not of the nature of "microscopic planes of slipping in the wall substance." (1)

Ramie: Ramie fibres which have been treated in the manner described are shown in *Pl. I*, *fig. 4* and *Pl. IV*, *fig. 16*. The spirals seen are obviously left-handed. Up to the present no ramie fibre has been found which shows the presence of an internal layer with a right-handed spiral formation. In the case of ramie, too, the layering of the cell-wall is usually much more difficult to demonstrate by this method, although indications of it are sometimes seen (*Fig. 16*.)

Hemp: Representations of similarly treated hemp fibres are shown in *Pl. II*, *figs. 9*, *10 and 11*, *and Pl. IV*, *fig. 17*. The spirals are in all cases right-handed and the layering of the wall is very readily seen. Usually two (sometimes three) main layers are visible, each of which has subdivisions. As an example of this, *Fig. 10* shows the presence of eight lamellae, and as many as thirteen have been very distinctly seen (*Fig. 11*). The slope of the spirally arranged fibrils is much the same as in flax, but often this is somewhat less and, in agreement with this, the fissures seen in an uncompressed fibre have more nearly a longitudinal direction.

Jute: When similarly treated, jute shows a general similarity to the other fibres. The spirals are right-handed (*Plate II*, *fig. 12*). There is in the case of this fibre, however, a very interesting phenomenon to be observed which is dependent upon the decomposition of the lignocellulose complex by pressure.[2] If the fibre is mounted in Schultz' solution and compressed the affected parts develop a purplish colour which indicates the liberation of free cellulose. The uncompressed fibre develops, of course, a brown colour. This reaction was recently of use in confirming a decision that the tendering of a jute weft in a sample submitted for examination was due to excessive pressure during calendering. The cut ends of jute fibres always stain a purplish colour with Schultz' solution (*Pl. II, fig. 13* —which shows a bundle of fibres) and it was found that the jute weft under consideration showed this reaction where it was crossed by the hard cotton warp. Jute fibres broken by *pulling* show practically no trace of a purple colouration. A jute fabric gently hammered on an anvil rapidly falls to a powder and the fragments show a deep purplish-blue colouration with Schultz' solution and a greenish blue with iodine and sulphuric acid.

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*They may at the same time constitute the individual particles of the cellulose colloid.

(1) *cf.* Robinson. "The microscopical Features of Mechanical Strains in Timber and the bearing of these on the Structure of the Cell Wall in Plants" (Phil. Trans., 1920, [B], **210**, p. 75).

[2] *cf.* Robinson, *loc. cit.*

Cotton: The cotton hair when examined by the compression method here described also shows a fibrillar structure and right and left-handed spirals occur in different parts of the same fibre.

The general similarity in the structure of the fibres examined is very striking and may be taken as confirming the view that the ligno-cellulose and pecto-cellulose complexes are of the nature of absorption compounds of cellulose.

SOME PROPERTIES OF TEXTILE FIBRES VIEWED IN THE LIGHT OF THE FOREGOING CONCLUSIONS.†

Much investigation as to the physico-chemical properties of cellulose and the structure of textile fibres is still urgently needed but in the light of present knowledge one may go a considerable way towards explaining many of the characteristic phenomena which are presented by such fibres.

In the living plant the fibres, which form an important part of the "mechanical tissue," have to withstand a variety of pulling, bending and twisting strains. The spiral arrangement of the fibrils composing the fibre is admirably adapted for this need; a degree of elasticity and pliability is secured which would not be obtainable with a simple hollow tube made of the same materials. A spill made from a strip of paper spirally twisted may be used to illustrate this in an interesting manner. The behaviour of cellulose under pressure probably contributes towards its suitability as a cell-wall material, since, as previously mentioned, it undergoes a change when compressed which causes it to absorb more water and to swell; by this action fibres which are compressed on the one side as the result of the bending caused by a gust of wind would tend to be straightened again.

"DISLOCATION MARKS" (VERSCHIEBUNGEN OF VON HÖHNEL).

It seems not unlikely that the well-known transverse markings of textile fibres may be caused by the subjection of the cellulose to a local pressure which produces in it a change accompanied by the absorption of more water and consequent swelling. The markings are often more or less at right angles to the trend of the fibrils and may possibly be due to the occurrence of an increase in volume too sudden to be taken up evenly by the spirals. The staining reaction of "dislocation marks" towards iodine is in agreement with the supposition that certain changes have taken place in the cellulose where they occur.

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† Since the investigation has reached its present stage our attention has been drawn to an article by Reimers (Textil Berichte, 1921, No. 20, p. 381) which had by some chance escaped our notice. This worker arrives at similar conclusions regarding the direction of the spiral twist in bast fibres. We are not, however, in agreement with the generalisations drawn by Reimers respecting the structure of fibres belonging to the "Hemp" and "Flax" Groups which he proposes to distinguish.

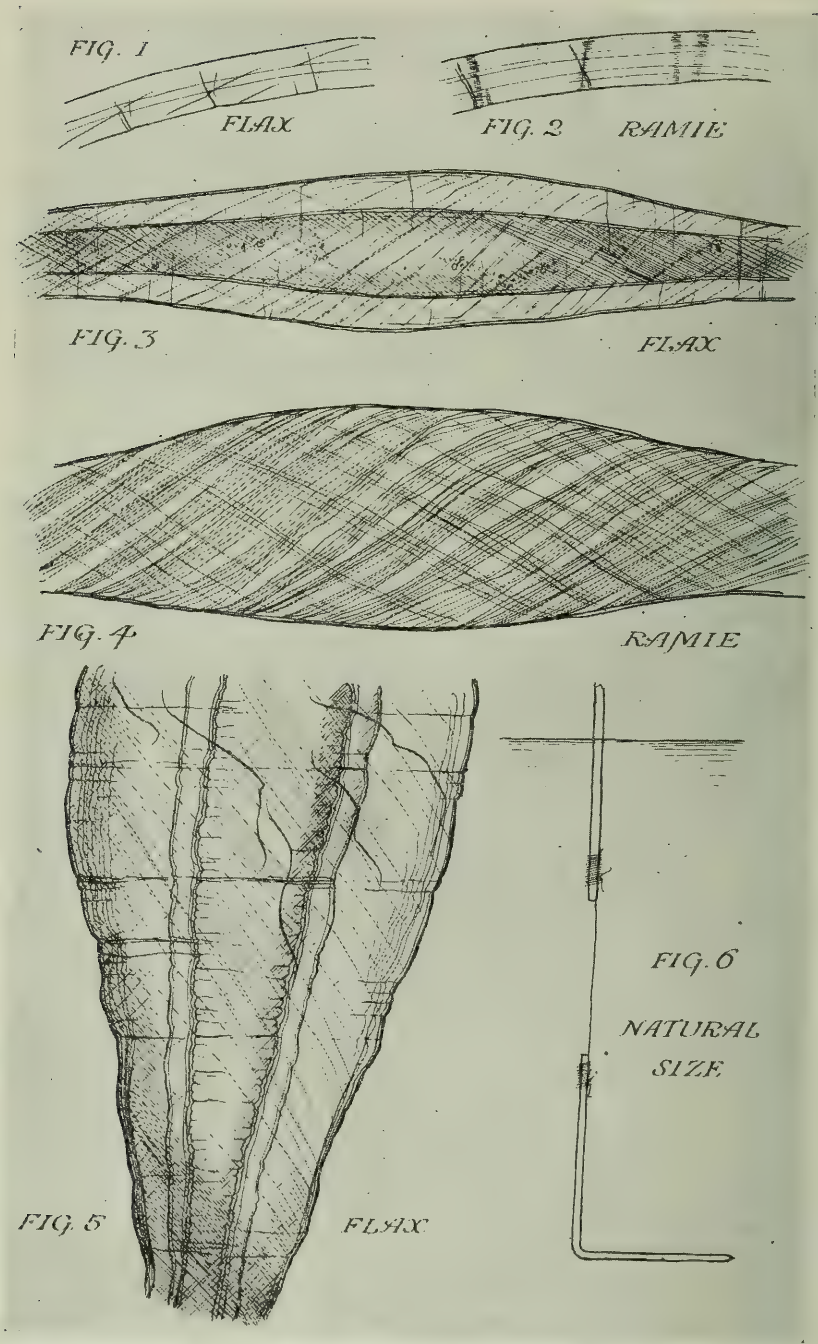

Plate I. (Magnification 240).

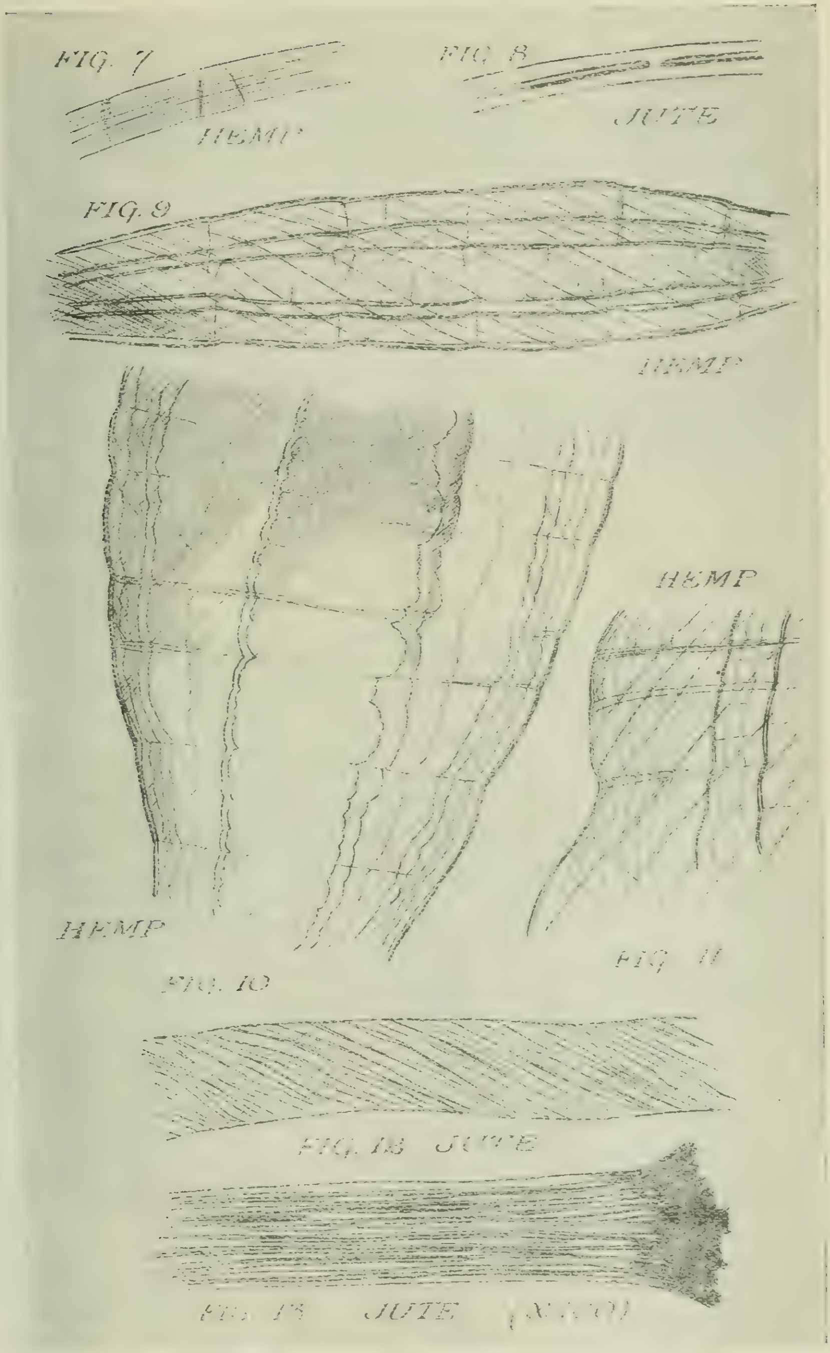

Plate II. (Magnification 240).

BEHAVIOUR OF FIBRES ON WETTING.

A flax fibre, on being wetted, contracts in length to the extent of a little less than two per cent. It seems reasonable to regard this contraction as due to a contraction of the component fibrils, which in turn will be due to a change in the relative dimensions of the cellulose molecule.* Besides getting shorter the flax fibre untwists on becoming wet. This untwisting may be considered as probably due to differences among the fibrils which make up the various lamellae of the outer layer of the cell-wall; that such a difference exists, in the case of cotton, has found acceptance in several quarters.(2) There is, indeed, little doubt that the untwisting of a fibre on wetting (or mercerising) is due to the fact that fibrils of the outer lamellae contract more than those of the inner lamellae, the action being similar to that of a Bréguet spiral. Whether these differences are due to variations in the chemical nature of the cellulose deposited in successive growth-layers, or to changes subsequent to its deposition, is a difficult matter to decide. It is likely that the fibrils which make up the older lamellae, situated towards the outside of the fibre, may be in a state of tension with regard to those which compose the newer lamellae towards the inside. Further, it is interesting to speculate as to the factors which may determine whether the fibrils shall form right or left-handed spirals. One is led to suppose that the spiral arrangement is an expression of molecular asymmetry and that there may be a certain difference between cellulose which appears in right and that which appears in left-handed spirals.

THE PROPERTIES OF YARNS.

Yarns are usually given a right-handed twist.** On wetting they tend to untwist owing, presumably, to the fact that the spinners' twist has produced a certain state of tension between the fibres which lie on the inside of the yarn spirals and those which lie on the outside. In the case of flax and ramie this tendency to untwist is opposed by the tendency of the individual fibres to untwist in the opposite direction; while in the case of hemp and jute the untwisting of the yarn is actually assisted by the behaviour of the fibres themselves. It may not therefore be a matter of complete indifference whether a yarn is given a right or a left-handed twist. One might expect on careful examination to find that hemp and flax yarns, similarly spun, show certain differences in behaviour, since the individual fibres tend to untwist in opposite directions in the two cases. It would not be surprising to find that, in the case of ramie for instance, a yarn which has been given a left-handed twist is weaker after wetting than one with a right-handed twist, other things being equal. Possibly also a hemp or jute yarn with a left-handed twist may possess advantages over a similar yarn spun with the usual right-handed twist. Such possibility seems especially worthy of attention in the case of hempen ropes which, in service, are alternately wetting and drying. These are interesting speculations which must await the results of further work for confirmation.

The force exerted by fibres on twisting and untwisting is no inconsiderable one. This may be well seen by suspending a single ramie fibre lashed at its lower end to an L-shaped glass index (*Pl. 1, fig. 6*). When the whole is submerged in water the fibre untwists and the force is sufficient to carry round quite a heavy glass index, at a fair speed, a number of times against the resistance of the water. The force exerted by a single

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* Such a change may be readily understood as due to the influence of an envelope of water upon the play of affinities within the cellulose molecule.

(2) See, for example, Second Report on Colloid Chemistry (1918), pp. 52-58, where several references are given.

** The Japanese, apparently, adopt a left-handed twist.

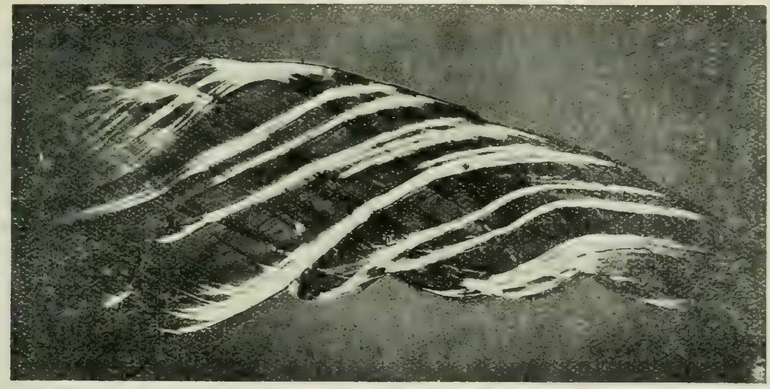

FIG. 14. Flax (x160).

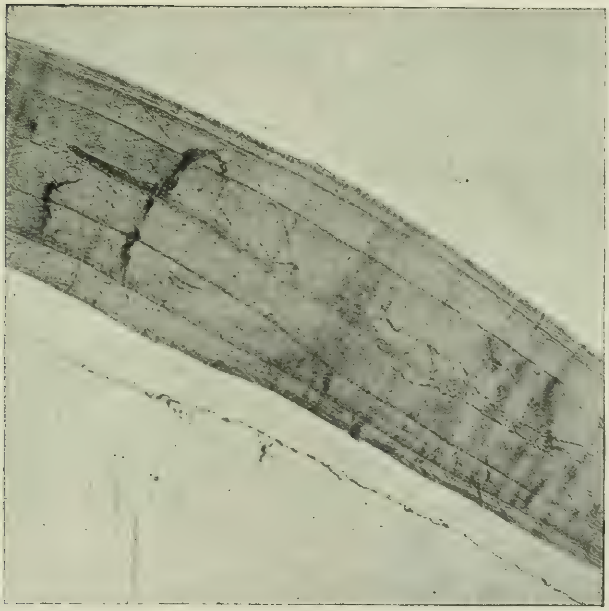

FIG. 15. Flax (x160).

PLATE III.

fibre could be measured by an experiment of a similar nature. The combined effect of thousands of fibres must be relatively very great. The wonderful strengthening effect obtained by moistening a ramie rove must be largely due to the fact that the untwisting of the fibres tends to reinforce the spinner's twist; this effect is particularly well seen in the case of ramie because the fibres are of considerable size and are not present in the form of bundles so that each is free to exert its independent force. The difficulty experienced in drawing a ramie rove, prepared in the usual manner and given the usual twist, without breaking the staple is well-known and may be partly accounted for by the action of these internal fibre forces.

The interlocking of the fibres in the yarn must be determined to a considerable extent by their property of twisting. Bearing in mind that hemp fibres tend to untwist in the reverse direction to that in which flax fibres tend to untwist, it is conceivable that, other things being equal, the number of turns per inch which is found in spinning to give greatest yarn-strength might be different in the two cases, it being understood, of course, that a right-handed twist is given to both. Flax and hemp yarns may be expected to manifest a divergent behaviour when the effect of variations of atmospheric humidity upon tensile strength is closely examined.

The shortening which takes place when a yarn is wetted is to be regarded as due, in the first place, to the shortening of the component fibres, which on the present view is in turn due to the contraction of the fibrils of which they are composed. In all probability, therefore, this shortening is the direct result of a change in the relative dimensions of the cellulose molecule. The percentage shortening of yarns is very much the same as that observed in the case of single fibres by means of an eyepiece micrometer.

The general recognition of the fact that " bast " fibres have in themselves to some extent the structure of yarns, some with right-handed and some with left-handed twists, may be expected ultimately to have considerable influence on practical methods. Further, it is possible that a fundamental property of the fibres themselves, such as the natural tendency to twist appears to be, may be associated with other factors in determining what is at present rather vaguely referred to as " spinning quality."

SUMMARY.

1. Flax and ramie fibres always twist in a clockwise direction when drying; hemp and jute fibres twist in the reverse direction.
2. Flax and hemp may therefore be readily distinguished from one another with the naked eye.
3. Microscopic examination of the above fibres, after they have been subjected to a certain treatment, shows them to have a fibrillar structure; the fibrils in the case of flax and ramie are arranged in left-handed spirals while in the case of hemp and jute they are arranged in right-handed spirals. (In some cases internal spirals with a reverse twist may occur.)
4. The drying of the above-mentioned fibres is therefore in all cases accompanied by a twisting up of the component fibrils. Conversely, moistening is accompanied by an untwisting of the fibrils.
5. This tendency of fibres to twist may be expected to have an important bearing upon the properties of yarns.
6. Attention is drawn to the possibility of explaining, in the light of the internal structure which has been revealed and the physico-chemical properties of cellulose, some of the characteristics exhibited by textile fibres.

NOTE REGARDING ILLUSTRATIONS.

Plates I and II are from drawings, and unless otherwise stated the magnification is 240 diameters in each figure. *Plates III and IV* are from microphotographs and

ERROR.—Plate IV on the other side of this sheet was inadvertently omitted from the September issue (Vol. XIII, No.9) of this Journal. Please insert plate between pages 170 and 171 of "Transactions."

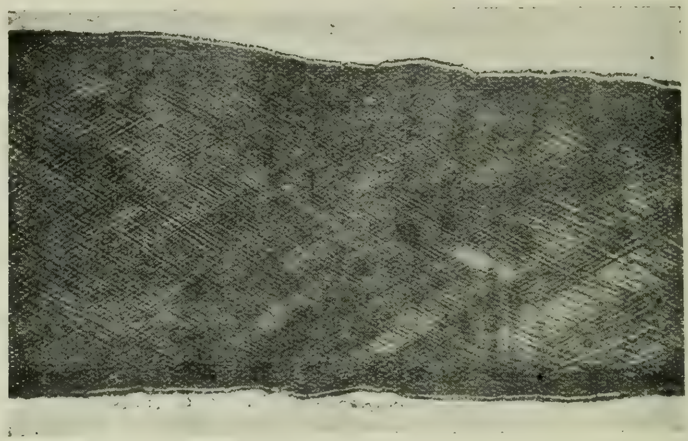

FIG. 16. Ramie (x160).

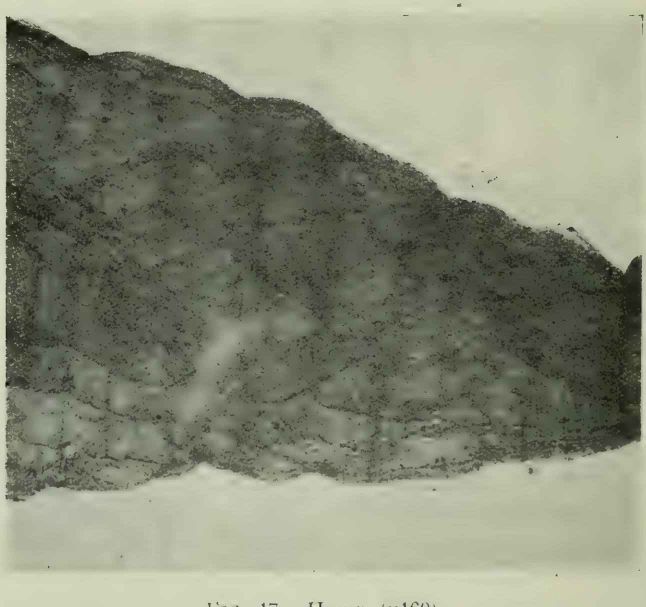

FIG. 17. Hemp (x160).

PLATE IV.

the magnification is 160 diameters in each figure. The drawings are semi-diagrammatic since it is impossible to show accurately the extreme fineness of the fibrils in illustrations of this size reproduced by the half-tone process. Moreover, it has in some cases been convenient to show in the same figure different parts of the same fibre at different levels of focus. In order to indicate the degree of increase in width undergone by the fibres when they are compressed there are shown in *Plate I, figs. 1 and 2* and in *Plate II, figs. 7 and 8* uncompressed fibres of flax, ramie, hemp and jute respectively. *Pl. III, fig. 14,* shows a flax fibre which has been treated with caustic soda solution and then compressed beneath the coverslip. The fibre was photographed in polarised light (between crossed Nicols). The existence of a left-handed spiral structure is well seen.

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SOME PHYSICAL QUANTITIES OF MULE YARNS.

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(I) THE RELATION BETWEEN THE TWIST AND THE AMOUNT OF FIBRE.

In a previous paper (this vol., pp.54-98) a method of measuring the regularity of a yarn was described, the quantity measured being the thickness under compression and small tension. This quantity, which might be termed the " hardness " is a function of the twist and number and fineness of the fibres in a cross section. A large amount of yarn from various cops was examined by this method, the same lengths being afterwards tested in $1\frac{1}{4}''$ pieces for twist. Thousands of readings were also taken of the breaking load of the same yarns, the test pieces being consecutive lengths of $3\frac{1}{2}$ inches.

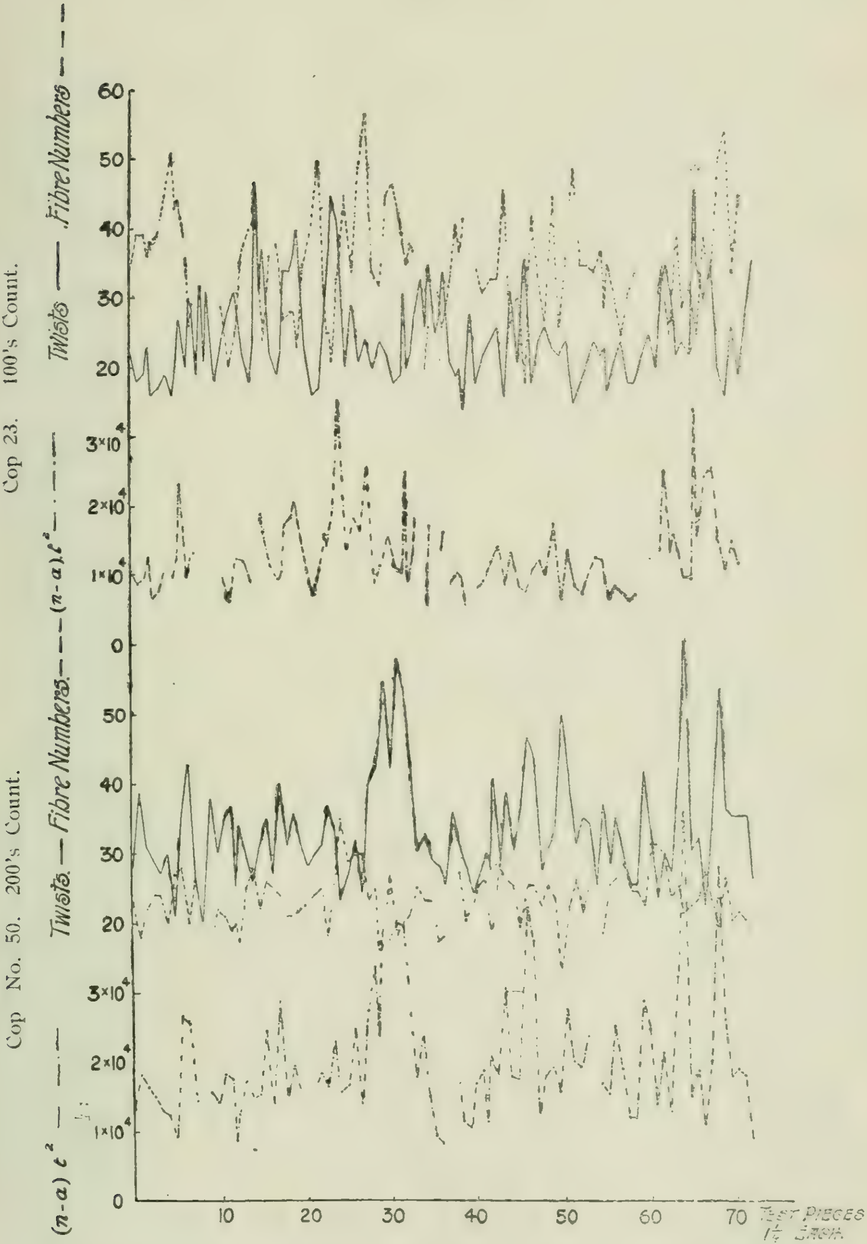
The twist specimens were marked and preserved in the order of testing so that they could be examined to find the relation between the amount of raw material and the twist at the same portion of the yarn, since these two factors should determine completely the qualities of the yarn, given the same quality of raw material. The fibres were counted under the microscope with a fairly low power, the ends of the specimens being carefully teased out with a needle. Four yarns of different counts were examined, some hundreds of consecutive measurements being made on each.

The number of fibres per section was next plotted against the distance along the yarn. This number varied by amounts up to about 50% above and below the mean, the variations showing no trace of periodicity, so far as can be traced by the eye. The regular periodicity of hardness, twist and tensile strength must be a pure spinning effect introduced by the transmission of all the twist from the spindle tip. (*loc. cit.* p.57.)

Many variable quantities enter into each of the hundreds of observations of fibre number and corresponding twist. The effect of the independent variable, the quantity of fibre, is determined not only by the number of fibres, but also by the shape and size of the cross-sections, the lengths and convolutions of the hairs, and the properties of the cuticle, etc. Superimposed on this effect is the periodic spinning effect previously referred to. The large number of readings, however, enables unknown random variations to be eliminated, and provides a means of isolating the effect on the twist of the two known quantities—(1) the number of fibres at a given section, and (2) the distance of this section along the draw.

Throughout the length of the same yarn, the only unknown variable which seriously affects the question is the average cross-section of the fibres at the point examined. As the twisting couple which determines the conditions of equilibrium depends on the square of the cross-sectional area, any variation of this quantity will have a large effect. In counting the fibres, it was plainly evident that a statistical average was not arrived at for individual sections, bunches of fine fibres being frequently observed.

PLATE I.



Horizontal distance between consecutive points = 1¼″ of actual yarn.

The results already obtained for the twists per inch, in consecutive specimens, were plotted alongside the corresponding values of the fibre number. The two graphs showed an almost invariable correspondence, the variations being in opposite ways. There is, however, no regularity in the amount of the variations for individual sections, and many exceptions occur even in direction, owing to the periodic variation along the draw and the random variations in fineness of the fibres. Two representative specimens of such graphs for 100's and 200's counts are shown in Plate I.

Though these effects vary appreciably for individual sections, they may be sufficiently eliminated to find a simple relation between fibre number and twist by finding the average twist which corresponds to given fibre numbers taken over the whole number of specimens from the same yarn. In this way, an average value is obtained which includes the influence of up to 800 fibres and this substantially eliminates the variation. The effect of the periodic variation is also distributed at random, and so the relation between twist and fibre number is obtained as an average over the length of the draw.

The first yarn examined was a cop of 200's count, Sea Island, the fibre numbers in 400 sections having been first counted. The average values of the various quantities involved are given in Table I, and the average value of the twists in relation to the corresponding fibre number is given in Table II. These average twists were plotted against the number of fibres and a smooth curve drawn through the points. This curve was found to be expressed by an equation of the form

$$(n - a) . t^2 = c \qquad \ldots\ldots\ldots\ldots\ldots\ldots (1).$$

where n is the number of fibres in a section of a specimen having t twists per inch, and a and c are two constants for the yarn. The values of n were also plotted against $1/t^2$, giving a straight line from which the values of a and c could be more easily estimated. Many other types of equation were tried, but the above was found to be the best for all the yarns, individually and collectively. For instance, an equation of the form $n.t^b = c$ may be found, which expresses the results as well as (1) over the range involved, but a different incommensurable value of the power b is necessary for the different yarns.

The best value of a was found from the graph connecting n and $1/t^2$ to the nearest integer, and then c was adjusted to satisfy the points nearest the mean, *i.e.*, those representing the largest number of sections and the truest average. This determination is as exact as possible, for, if c be adjusted to small variations of a, the difference is only appreciable at the extremities of the curve where the points are not very determinate.

The same methods were then applied to the other yarns, which were also found to follow this law with an exactitude depending on the number of readings used and on the number and uniformity of the fibres. The 32's yarn gave particular trouble in counting the fibres owing to the large number in each section. For this reason, to get a better average, the fibre numbers are grouped in threes, the number given being the middle one. The resulting curves are shown on Plates IIa, IIb, IIc and IId.

In the following lists of particulars, the observed counts (represented by N) were found from the unused portion of the cops, the actual yarn previously used not having been weighed. These values are taken in calculations involving the counts as somewhat more probable than the counts to which the yarn was said to be spun.

The quantity p is the constant in the mill-rule, viz., Twists per inch = constant × $\sqrt{\text{counts}}$. For this type of yarn, it is usually taken as 3·2 approximately and the change wheels adjusted accordingly. It will be seen that there is a difference (loss) due to fibre slip, of about 20% between the twists put in at the spindle and that observed in the yarn (*loc. cit.* p.93).

TABLE II.

COP No. 50. 200's COUNT. SEA ISLAND.

FIBRE NUMBERS.

12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
50		51	51	44	38	32	42	43	36	41	41	25	32	27
61		51	39	48	34	39	45	38	35	30	28	40	30	27
50		60	48	46	41	37	37	33	31	31	40	29	27	35
			64	40	28	55	37	25	36	32	33	27	31	30
				42	37	58	36	33	45	31	33	30	26	39
				42	35	25	54	30	35	24	29	25	30	31
				36	42	32	38	28	61	27	27	25	42	34
					45	26	45	53	35	41	32	32	47	35
					34	49	46	28	49	42	34	43	44	27
					46	49	31	35	59	30	35	35	30	35
					48	38	44	35	31	42	44	45	30	30
					62	35	30	39	58	36	38	32	28	36
					52	66	30	45	40	47	37	37	41	34
					40	55	40	34	35	40	36	40	30	35
					34	50	43	29	48	40	30	38	47	34
						38	43	47	41	54	47	26	24	30
						39	39	37	28	25	40	41	37	34
						40	25	38	30	36	29	33	37	31
						35	48	38	40	42	31	30	40	35
						37	34	34	39	29	33	30	42	44
						33	37	52	42	24	41	36	25	29
						38	33	30	42	27	37	28	32	26
						49		38	42	40	39	28	40	46
								37	39	26	29	27	29	35
								49	32	33			36	29
								30	35	40			37	34
								47	44	30			37	31
								36	28	24			41	31
								41	39	49			26	22
								37	27				26	
								38	34				40	
								31	33				31	
								39	30				30	
								30	31				28	
								22	25				20	
									25					
									34					
									35					
									29					
161	.	162	202	298	616	955	857	1279	1458	1013	843	782	1173	946
3		3	4	7	15	23	22	35	39	29	24	24	35	29
53·6		54·0	50·5	42·6	41·1	41·5	39·0	36·5	37·4	35·0	35·1	32·6	33·5	32·6

27	28	29	30	31	32	33	34	35	36	37	38	39	40
21	35	27	32	31	26	30	20	23			18	35	
33	26	30	24	23	28	26	20	27			24	23	
42	28	24	36	41	40	34	35					23	
31	29	24	32	35	29	32	16						
22	26	42	42	34	27	30							
29	36	25	22	41	22	22							
28	35	47	34	32	18	37							
42	31	46	31	22	25	27							
23	41	32	30	30	36								
35	39	28	30	25	25								
33	41	24	22	34									
33	26	34	33	20									
45	24	28	23										
28	33		32										
29	21		26										
20	32												
20	21												
31	19												
22	19												
	30												
567	592	411	449	368	276	238	91	50	...	...	42	81	
19	20	13	15	12	10	8	4	2	...	.	2	3	.
29·8	29·6	31·6	29·9	30·7	27·6	29·8	22·8	25	...	.	21·0	27·0	...

Total Twists 13910
No. of Specimens 400
Average .... 34·8

Plate IIa.

Cop No. 50, 200's Sea Island.
$(n-5).t^2=22{,}000.$

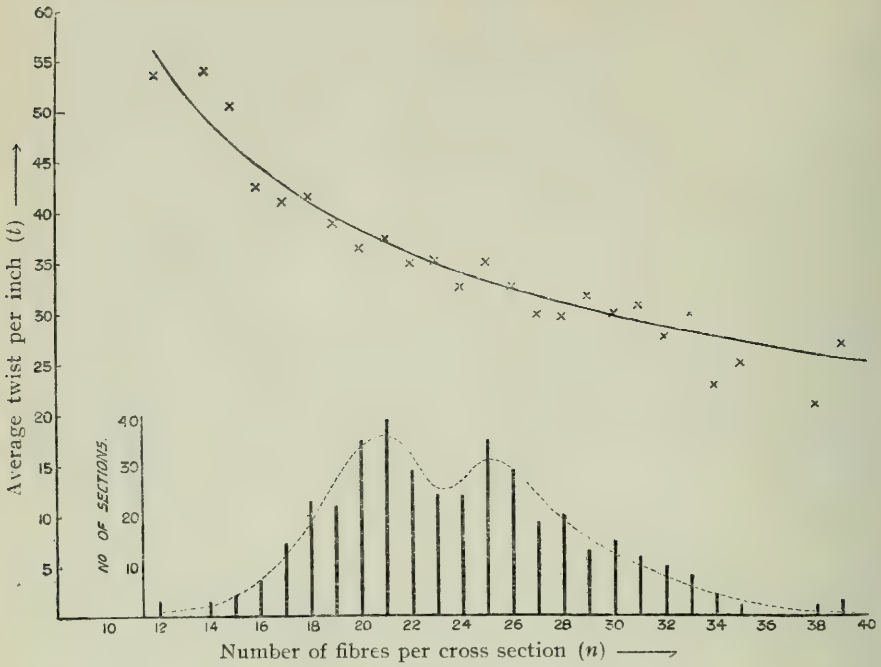


Plate IIb.

Cop No. 19, 175's Sea Island.
$(n-7).t^2=13{,}000.$

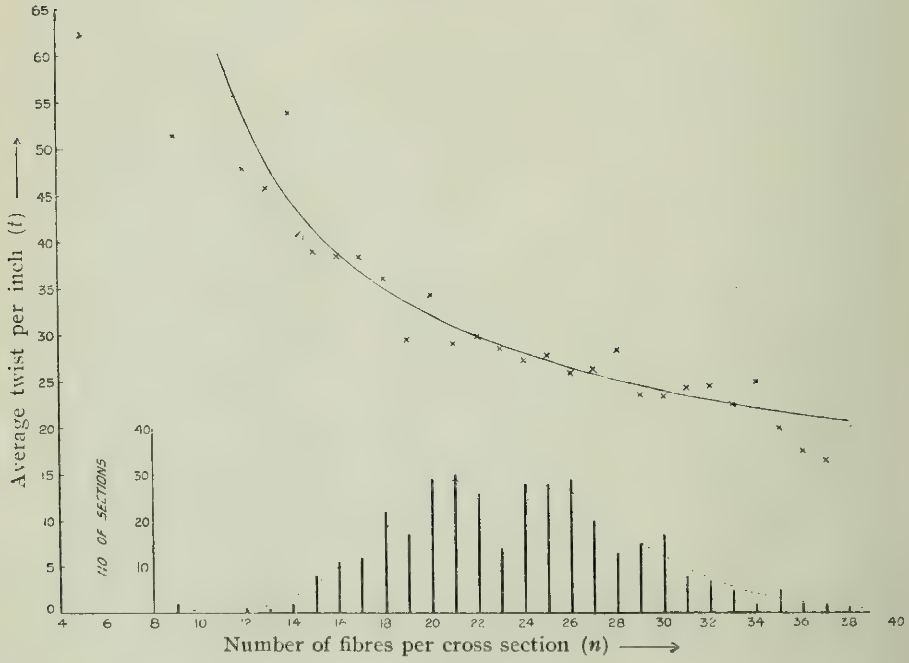
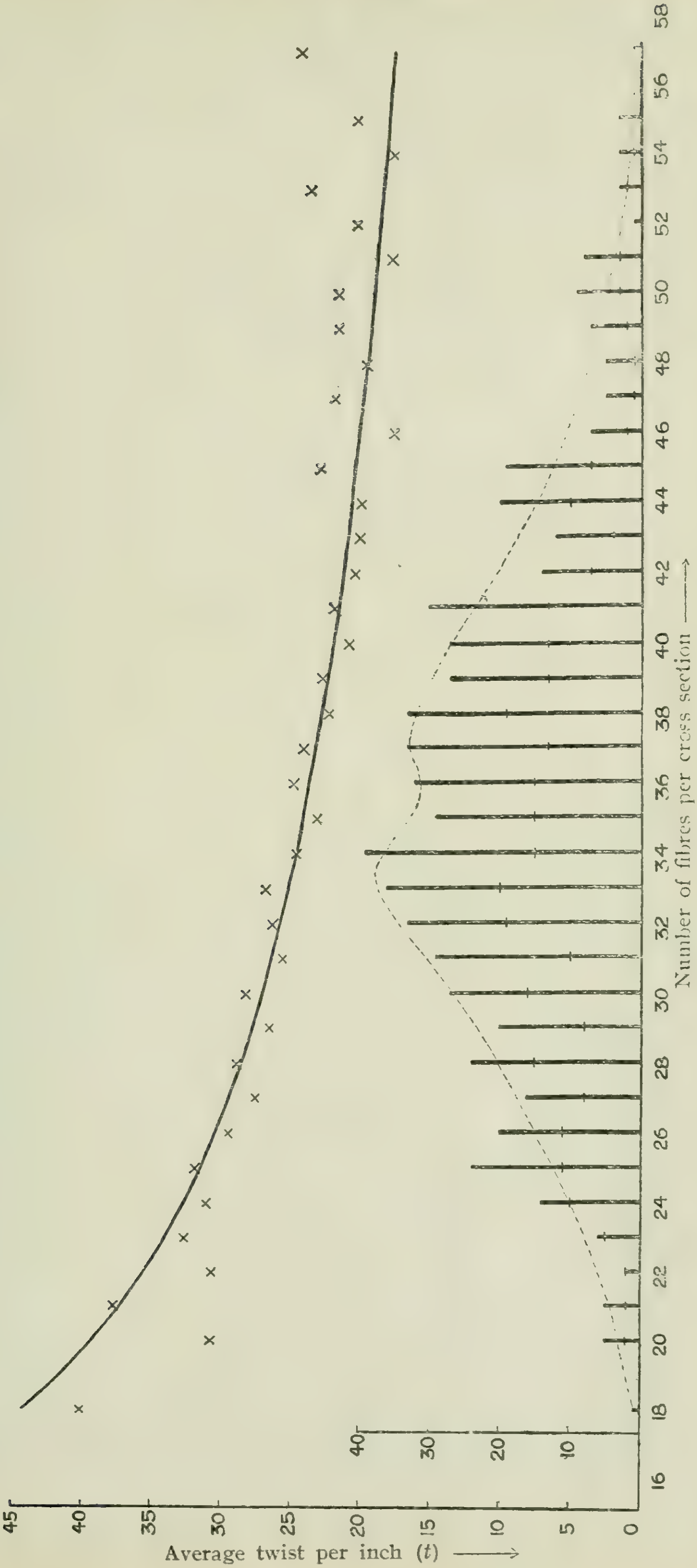


PLATE IIc.

Cop No. 23, 100's Egyptian.

$(n-11).t^2 = 13,700.$



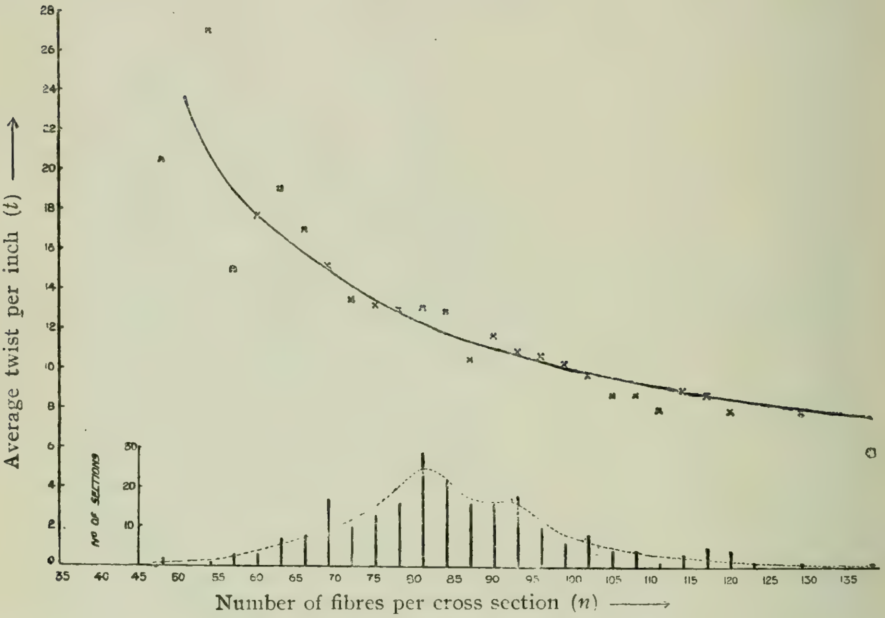
The quantity m_0 is the average mass per fibre per yard of yarn, which, corrected for obliquity of fibres (p.179), is a measure of the fineness of the cotton. If $\bar{n}$ is the mean number of fibres per cross-section,

$$m_o = \frac{1}{840\ N\ \bar{n}}.$$

The length of the period l is found by inspection of the graph of the twists and the quantity $(n-a).t^2$ and agrees well with that found from the photographs, from the tensile tests, and from the actual length of the mule draw (*loc. cit.* pp.59, 72).

Plate IId.

Cop No. 48, 32's Egyptian.
$(n\text{-}44).t^2 = 5{,}560.$



In the 100's yarn, two different portions were examined. These are recorded separately to show the probable variation in the quantities estimated in this way.

TABLE I.—PARTICULARS OF THE YARNS EXAMINED.

Counts 200's, observed (N) 197's. Sea Island Cotton.
Cop 50. Photographic test 48 (see Plate V. in paper referred to above).
Number of Sections 400.
* Mean number of fibres per section ($\bar{n}$) = 23.7.
† Sub-mean ($\bar{n}'$) = 19·9. Irregularity, measured by the quantity $\frac{\bar{n} - \bar{n}'}{n} = 16\ \%$.
Mean number of twists per inch ($\bar{t}$) = 34·8.
$p = \frac{t}{\sqrt{N}} = 2{\cdot}48.$
$m_o = 2{\cdot}57 \times 10^{-7}$ lbs. per yard.

---

* Throughout the paper, the quantities marked with a bar ($\bar{n}$) are averages over a length of yarn; the plain symbol (n) representing the value for an individual section.

† The Sub-mean is the mean of all those observations which are equal to or less than the mean of all the observations. It is an indication of the extent of variation *below* the mean which has an important practical significance.

The best equations connecting the number of fibres, n, and the corresponding twists per inch, t, for individual sections are :—
$(n - 5) . t^2 = 22{,}000$, and $(\bar{n} - 5) . \bar{t}^2 = 22{,}600$, which shows the closeness of the " fit " when mean values of n and t are substituted.
The length of the period, l, = 55 inches. Photographic test No. 48 gave 56 inches.

Counts 175's. Sea Island Cotton.
Cop 19. Photographic tests Nos. 50 and 51. (Plates III. and IV. in paper referred to above). Number of sections 357.
$\bar{n} = 23{\cdot}6$ fibres per section, $\bar{n}' = 19{\cdot}4$. Irregularity = 17·8 %.
$\bar{t} = 29{\cdot}5$ twists per inch. $p = 2{\cdot}23$.
$m_0 = 2{\cdot}89 \times 10^{-7}$ lbs. per yard.
Best equations :—$(n - 7) . t^2 = 13{,}000$, and $(\bar{n} - 7) . \bar{t}^2 = 14{,}350$.
$l = 60$ inches. Photographic test No. 51 gave 60 inches.

Counts 100's. $N = 103$'s. Egyptian Cotton.
Cop 23. Two series (a) and (b). 629 sections. (a) Photographic test No. 40, 300 sections ; (b) Photographic tests Nos. 42 and 43, (Plates I. and II. in paper referred to above), 329 sections.
(a) $\bar{n} = 34.4$, $\bar{n}' = 29{\cdot}0$. Irregularity 15·7 %.
(b) $\bar{n} = 36{\cdot}2$, $\bar{n}' = 30{\cdot}7$. Irregularity 15·3 %.
(a) $\bar{t} = 25{\cdot}0$ twists per inch. $p = 2{\cdot}46$.
(b) $\bar{t} = 24{\cdot}3$ twists per inch. $p = 2{\cdot}40$.
(a) $m_0 = 3{\cdot}36 \times 10^{-7}$ lbs. per yard.
(b) $m_0 = 3{\cdot}20 \times 10^{-7}$ lbs. per yard.
$l = 62{\cdot}5$ inches. The photographic tests showed that the period varied from 60·9 to 63·8 inches ; the mean of these is 62·3 inches. Best equations :—
$(n - 11) . t^2 = 13{,}700$, and (a) $(\bar{n} - 11) . \bar{t}^2 = 14{,}320$; (b) $(\bar{n} - 11) . \bar{t}^2 = 14{,}880$.

Counts 32's. $N = 33$'s. Egyptian Cotton.
Cop 48. 257 sections.
$\bar{n} = 83{\cdot}6$, $\bar{n}' = 65{\cdot}5$. Irregularity 21·6 %.
$\bar{t} = 13{\cdot}0$ twists per inch. $p = 2{\cdot}26$.
$m_0 = 4{\cdot}32 \times 10^{-7}$ lbs. per yard.
$l = 58$ inches. Photographic test No. 46 (Plate VII. in paper referred to above) gave 58 inches.
Best equations :—$(n - 44) . t^2 = 5{,}560$, and $(\bar{n} - 44) . \bar{t}^2 = 6{,}700$.

(II.) THE FIBRE CROSS-SECTION.

The frequency curves of the fibre numbers (Plates IIa. b. c. d) are of interest, as they show, especially in the finer counts, an extra " mode " or maximum above the mean. This is undoubtedly due to the systematic variation caused by the presence of bunches of fine hairs such as were observed in counting, which, being a departure from the perfectly random distribution of fibres along the yarn, results in a corresponding departure from the true probability curve. As observed, these bunches of fine fibres are more probable in sections of high fibre number, and they introduce a tendency for irregular values of the twist to occur, which are higher than would be expected, at the corresponding end of the curve. This consideration, and that of the number of sections involved, must be taken into account in allowing due weight to be given to the various points on the curve. It is also noticeable that the finer yarns are more regular in fibre distribution than the 32's. This is probably due to the fact that they were combed, and it would be expected that the opposite would be true if all the cottons had been similarly treated.

A measure of the fineness of the cotton may be obtained from m_0 by applying a correction for the obliquity of the fibres. If s is the normal cross-section of a fibre, s_0 the cross-section normal to the axis of the yarn, $s = s_0 . \cos\theta$, where θ is the angle between the fibre and the axis. Assuming a constant density of fibres over the cross-section,

$$\frac{s}{s_0} = \frac{1}{\pi R^2} \cdot \int_0^R 2\pi r . \, dr . \cos\theta = \frac{\sqrt{1 + 4\pi^2 R^2 t^2} - 1}{2\pi^2 R^2 t^2 .}$$

since
$$\theta = \tan^{-1} 2\pi r t = \cos^{-1} \frac{1}{\sqrt{4\pi^2 r^2 t^2 + 1}}$$

This is a small correction and, in estimating its value, it may be said that approximately t^2 varies directly and R^2 indirectly as the counts. Hence

R^2t^2 is constant, and, from measured diameters (see below, p. 186) and known twists, its average value for the different yarns is 1/500 and $4\pi^2R^2t^2=0{\cdot}079$. Therefore $(s_0-s)/s_0=0{\cdot}02$, *i.e.*, a correction of 2% should be subtracted from the value obtained for m_0. Assuming the density of the fibre material to be 1·5, the cross-section ($\bar{s}$), in square inches, and the mass per yard in lbs. ($\bar{m}$), are connected by the relation

$$\bar{s}=\frac{\bar{m}}{1{\cdot}95}=\frac{1}{840N\bar{n}}\cdot\frac{49}{50}\cdot\frac{1}{1{\cdot}95}=\frac{1}{1680N\bar{n}}=\frac{5{\cdot}96\times10^{-3}}{Nn}\text{sq. ins.}$$

This indicates a method of some general value, as it gives the area of cross-section of the walls of the fibre, averaged over thousands of fibres. The actual numerical values, in this case, are uncertain to the extent of the probable variation of the counts because the actual material used had not been weighed. This quantity is the best one for defining the fineness of the cotton and has much more meaning than the visual diameter, or ribbon width and thickness, or even the cross-section obtained by direct measurement. With an irregular form such as that of the cotton fibre, diameter and area of cross-section are indefinite quantities unless the latter be defined as the volume per unit length, which is the quantity obtained above. The cross-sections found in this way are:—

	Sea Island Cotton.		Egyptian Cotton.	
Counts	200's.	175's.	100's.	32's.
$\bar{s}\times10^7$ sq. in.	1·28	1·44	1·63	2·15

The variation shown indicates that the average diameter of the coarser Egyptian cotton is 1·3 times that of the finer Sea Island.

(III.) THE GENERALISED FORMULA OF TWIST AND FIBRE NUMBER.

It has been shown, by the foregoing observations, that the relation between the twists per inch and the number of fibres may be generally expressed in the form $(n-a).t^2=c$ where a and c are constants for any one yarn. This must express the conditions of equilibrium, as far as n and t are concerned, in the newly-spun yarn, *i.e.*, the couple tending to untwist the yarn must be proportional to c. The couple also depends upon the elastic properties, and on the size and shape of the fibres. To make this expression valid, even for the simplest case, viz., a stretch of single yarn, the effect of varying cross-section of the fibres must be included, this having been eliminated by the statistical method. A knowledge of this variation is still more necessary in comparing yarns made from different raw material.

The stresses due to the twisting and bending of a fibre may be represented by two couples, one with its axis normal to that of the yarn, the other parallel. The total moment of the former couple, summed over a symmetrical cross-section, vanishes. To these forces the internal pressure in the yarn is due and they also determine a tendency to snarl (particularly noticeable where the twist is excessive) as soon as symmetry is destroyed, *e.g.*, by slightly bending the yarn. The summation of the latter couples over a cross-section of the yarn gives the twisting couple which determines the conditions of equilibrium. This couple may be expressed by

$$M=s^2.Aqf(n,t,\sigma)$$

where A is a pure number, depending on the geometrical shape of the fibres, q is a modulus of elasticity and σ is a small length. The expression $f\ (n,t,\sigma)$ is complicated even if the fibres are assumed to be perfectly elastic. If the relation between n and t (see p. 174) is true, then

$$f(n,t,\sigma)=b(n-a).t^2.$$

where b is a small length, independent of n and t, determined by the distribution and packing of the fibres. The twisting couple may now be written:—

$$M=s^2(n-a).t^2..A.b.q\ldots\ldots\ldots\ldots(2).$$

In this form the equation takes account of all the significant factors and is dimensionally complete. Written in the form:—

$$s^2(n-a).t^2=\frac{M}{A.b.q.}=C. \quad \ldots\ldots\ldots\ldots\ldots\ldots(3)$$

where c is independent of variation in n, t and s, allowance is made for the effect of variations in the fineness of the fibres for any section of a yarn. In Table III below, the value of $\bar{s}^2.c$ which is the average value of c for a yarn, is shown to depend only on p, and is the same for yarns of any count spun to the same constant.

(IV.) THE MILL RULE. TWISTS PER INCH=CONST. × √COUNTS.

The above rule expressed in the symbols adopted in this paper is:—

$$t=p.\sqrt{N} \quad \text{or} \quad \frac{t^2}{N}=p^2.$$

i.e.

$$t^2.840.n.m=p^2.$$

or

$$\bar{s}.\bar{n}.\bar{t}^2=\frac{p^2}{1680}$$

If both sides of this expression are multiplied by $\frac{(\bar{n}-a).\bar{s}}{\bar{n}}$ then

$$\bar{s}.^2(n-a).\bar{t}^2=\frac{p^2}{1680}.\frac{(\bar{n}-a)}{\bar{n}}.\bar{s}.$$

It is a curious fact that the value of $\frac{(\bar{n}-a).\bar{s}}{\bar{n}}$, despite the large variations in the values of $\bar{n}$, $\bar{s}$, and a, for counts, 200's, 175's, 100's, and 32's, is constant for all the yarns, to within the limit of error in determining these quantities, the greatest variation from the mean value, $1{\cdot}05\times10^{-7}$ sq. in., being under 8%. This quantity might be termed the average effective cross-section of a fibre. Inserting this value, the mill rule becomes

$$\bar{s}^2(\bar{n}-a).t^2=\frac{p^2\times10^{-7}}{1600} \quad \text{or} \quad \frac{\bar{s}^2(\bar{n}-a).\bar{t}^2}{p^2}=0{\cdot}625\times10^{-10} \quad \ldots\ldots\ldots\ldots(4)$$

From Table III, it is seen that $\bar{s}^2.\bar{c}/p^2$ is constant and equal to $0{\cdot}62\times10^{-10}$. The greatest variation ($7\frac{1}{2}$%) from the mean was found in the 100's counts (cop 23), and even this would be reduced to 3% if a were given the value 12 instead of 11. It was difficult to decide which of these numbers gave the better fit. The quantities on which the value of the expression depends, viz., N, $\bar{n}$ and a, vary from yarn to yarn by factors of 6, 4, and 9, so that the agreement is very decided.

TABLE III.

No. of Cop	50	19	23		48
Variety of Cotton	Sea Island	Sea Island.	Egyptian.		Egyptian.
No. of Specimens examined	400	357	629	(a) 300 (b) 329	257
Counts (mill)	200's.	175's.	100's.	....	32's.
Counts (N. obs.)	197's.	....	103's.	....	33's.
n	23·7	23·6	35·3	(a) 34·4 (b) 36·2	83·6
$\bar{t}$	34·8	29·5	24·6	(a) 25·0 (b) 24·3	13·0
a	5	7	11		41
c	22,000	13,000	13,700	...	5,560
* p	2·48	2·23	2·43	(a) 2·46 (b) 2·40	2·23

* $p=\bar{t}/\sqrt{N}$.

TABLE III.—*continued.*

No. of Cop	50	19	23		48
Variety of Cotton	Sea Island	Sea Island.	Egyptian.		Egyptian.
† $\bar{s} \times 10^7$ sq. in.	1·28	1·44	1·63	(a) 1·68 (b) 1·59	2·16
$\frac{(n-a).\bar{s}\times 10^7}{\bar{n}}$	1·01	1·01	1·12	(a) 1·14 (b) 1·11	1·06. mean 1·05
$\bar{s}^2 c \times 10^{10}$	3·60	2·69	3·65		2·59
‡ $\frac{\bar{s}^2 \bar{c} \times 10^{10}}{p^2}$	·599	·604	·670		·608. mean ·62
$\bar{T}$ (ozs.)	1·47	1·48	2·80		5·63
$Q=\frac{\bar{T}.N.}{p.}$	118·5	116	115		80
Breaking stress $\times 10^{-4}$ (lbs. per sq. in.)	1·46	....	1·70		1·05
Diameter (ins.) $\bar{D} \times 10^3$	3·01	....	3·78		7·27
Thickness under compression in regularity tester, $\bar{H} \times 10^3$	0·9	....	1·5		3·4

*(a) and (b) refer to different series of tests.

$$\dagger\ \bar{s} = \frac{1}{1680N\bar{n}} \qquad \ddagger\ \frac{\bar{s}^2\bar{c}}{p^2} = \frac{\bar{n}-a}{1680^2 N\bar{n}^2}$$

The results obtained may be summarised as follows:—

Observations of twists and fibre numbers lead to the expression $(n-a).t^2=c$ along the length of any one yarn. This relation when generalised by statistical considerations becomes:

$$s^2(n-a)t^2=\frac{M.}{b.A.q.}$$

which holds for any yarn.

The mill rule for spinning is shown to involve the equation

$$\bar{s}^2(\bar{n}-a).\bar{t}^2 = p^2 \times 0{\cdot}62 \times 10^{-10}$$

Thus this purely empirical rule is the simplest possible expression, in terms of the average values, which are all that concern the spinner, of the relation between the amount of fibre and the twist. In spinning to the same p for all counts, a spinner obtains the same value of M/b, a quantity which might be termed the *spinning force*. In general

$$\frac{M}{b}=p^2\times 0{\cdot}62\times 10^{-10}A.q. \quad \text{where } p=\frac{\bar{t}}{\sqrt{\bar{N}}}.$$

It must here be noted that the value of p is not identical with the constant by which the mule gearing is adjusted but about 20% lower owing to fibre slip in spinning (*loc. cit.*, p.93).

The quantity M/b, a force varying only with p^2, suggests itself as a standard of conditioning, the residual value in a conditioned yarn being a measure of the amount of conditioning. The absolute values of M and b and their variation with the counts can only be determined by measuring the couple in newly spun yarns. This is now being investigated.

(V.) THE PERIODIC VARIATION OF TWIST IN MULE YARNS.

It has been shown in the paper referred to above (Plates I—XXVIII) that in mule yarns the twist, as well as the hardness and tensile strength, has a periodic maximum independent of the variation of the amount of fibre. This superimposed effect is greatest at those points of the yarn which were at the spindle tip during spinning. All the twist that the yarn acquires is fed in at this point. About 20% of this is lost through fibre slip, the remainder being distributed throughout the draw, the transmission of twist taking place in virtue of the elastic forces exerted by the fibres. If the fibres were perfectly elastic and did not slip, equilibrium along each draw would be determined by a constant couple and an even distribution of twist. Each transmitting element of the yarn, however, must be given a higher twist than it finally retains, in order to pass it on. Owing to imperfect elastic restitution, each element exerts a force in untwisting which is less than that by which it resisted torsion, so that, for equilibrium, the degree of twist must continually decrease from the spindle tip to the roller. In other words, this superimposed effect implies that the function s^2 $(n-a)$. $t^2 = C$ must so vary. The gradient (see Plates I—IX of the paper quoted) depends on the amount by which the element of yarn is overtwisted during spinning, and this depends on the spindle speed and the rate of propagation of twist along the fibres. Some preliminary experiments on a conditioned yarn showed this elastic fatigue clearly. The top of the thread was first twisted up, next the bottom was allowed to untwist. The couple exerted, measured by a magnetic control, was much less in the latter case for the same twist.

The variation of twist along a draw may be expressed by:—

$$\bar{s}^2(n-a).t^2 = C_0 f(d) \qquad \ldots\ldots (5).$$

where c_0 is the value of the twist at the rollers and d the distance along the draw measured from the rollers.

Having now determined the relation of twist to the amount of fibre, it is possible to eliminate the effect of variations of twist due to irregularity of roving and to determine the true amount of variation of twist introduced by the mule mechanism. The values of the function $(n-a)$. t^2 were plotted, for the individual points, alongside the corresponding graphs for n and t (see Plate I). The graph showed the gradual rise of twist and the maximum of the mule draw, but the large unknown variation of s^2 caused irregularities. It is possible to eliminate this variation to a considerable extent by averaging the values for corresponding points of the periods. The length of the periods is known from the photographic tests, the tensile tests, and by inspection of the maxima shown in the graphs of t and c. This enabled the graphs to be cut up into an equal number of periods. To get a better average, the specimens were taken two at a time, *i.e.*, over lengths of 2½in. for each point of the composite curve. This is sufficient, not indeed to give a perfectly even curve, but to smooth out chance irregularities of fibre so that the true shape of the curve may be definitely seen. In Plate III, the resulting composite periods are shown for the quantities n, t, and $\bar{s}^2.c$, meaned over the specimens used in the foregoing observations.

The smooth curves, in all cases, represent the values which should be given by averaging over an infinite number of periods. In particular, the smooth curves for the twists are calculated from those of $\bar{s}^2.(n-a).t^2$, by dividing by the average value of $\bar{s}^2.(\bar{n}-a)$ thus eliminating the effect of varying fibre numbers. The statistical method tends to eliminate (1) the variations in fibre cross-section, (2) the variation of number of fibres per cross-section. Thus it will be seen that the variation of twist with fibre number is much more consistent when treated in this way than it is for any individual period. The number of fibres still varies, though much less than in the original periods. The irregularities remaining indicate the degree to which this limited amount of averaging falls short of statistical perfection which would give a straight line. The smooth curves represent the values of twist, etc., corresponding to this straight line, *i.e.*, to the ideal distribution of fibres, and therefore they represent the pure spinning effect.

The curves have been arranged to show at a glance how the quantities concerned vary with each other along the draw of a particular yarn and how they vary from yarn to yarn. The twist and fibre numbers are on the same scale for each yarn, except for the 32's, where the twists are multiplied, and the fibre numbers divided by three, to show the variation in the same proportions as in the other yarns.

The curves for $\bar{s}^2 . (n-a) . t^2$ represent the function $f\ (d)$ of equation (5), which holds for $C_0 f(d)$, M/b, t^2 (with uniformity of fibres and their distribution), or c in the original formula (1). The value of $\bar{s}^2 . c$. is remarkably constant, varying less from yarn to yarn than along any one draw. If p, the spinning constant, on which only it depends, be taken as the zero, the curves are practically continuous. (See Plate III.)

Taken together with the curves of Plate II, all the varying factors in a yarn are thus specified and correlated. In the latter, the periods are averaged out, in the former the variations of the fibre number, in both the unknown effects of variation of fibre, cross-section, etc. These conclusions are incorporated in the complete formulæ:—

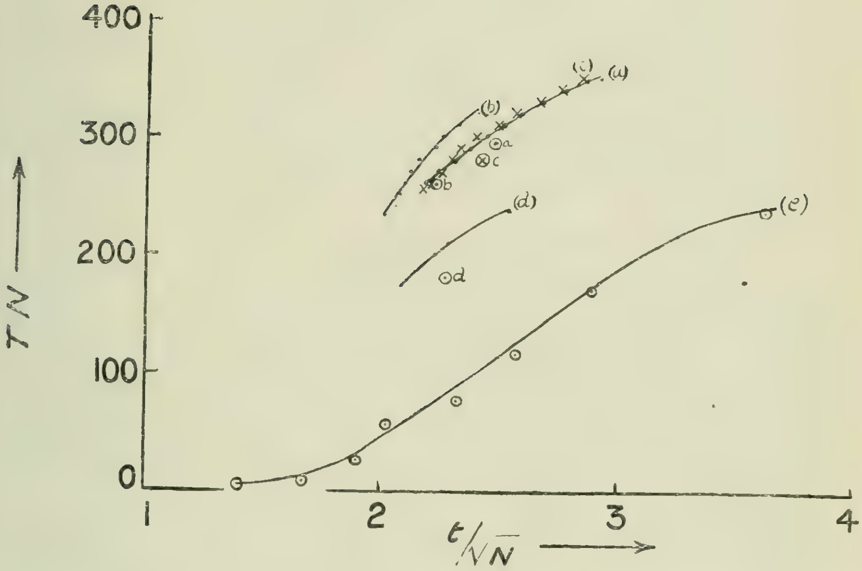
$$\bar{s}^2(n-a) . t^2 = C_0 . f\,(d). \text{ and } \bar{s}^2(\bar{n}-a) . t^2 = 0{\cdot}62 \times 10^{-10} p^2 = \frac{M.}{bAq.}$$

It is now possible to relate the practical qualities of a yarn to these quantities on which they depend (1) along a given yarn, and (2) from yarn to yarn.

The method of composite periods has been applied to the tests on breaking load made on the same cops. A greater number of periods was available for this purpose and a much better defined curve was obtained showing the way in which the strength varies along the draw and the correspondence with the variations of $s^2 . c$ and t. The breaking loads (T) were found for lengths of 3½in., and are plotted on the same linear scale as the other quantities. The values are plotted as TN to allow comparison between the various yarns. This quantity is the breaking length expressed in units of 1/16th hank or 52½ yards, the breaking load being in ounces. The variation along the draw seems to be very much the same as that of the twist. This relationship may be determined more exactly by plotting the breaking length against the corresponding twist, or preferably against $t/\sqrt{N}$. Investigations on the effect of varying twist of a yarn on its strength, in this laboratory and by Gégauff (*Bull. Soc. Ind., Mulhouse*, April, 1907), show that $t/\sqrt{N}$ is the same for corresponding points on the twist-strength curve, and, in fact, plotted in this way, the curve is very nearly the same for all counts of identical quality. The quantity $T . N . \sqrt{N}/t$ may be termed the *quality number* and it is practically identical for the three combed yarns. The portions of these curves, within the limits of the variations of twist along the draws, are shown in Fig. I, along with the curve (e) obtained on 100's yarn by varying the twist in the yarn. They fall in that part of the curve where the relationship is practically linear, even for the regions of high twist. This, of course, in a weft yarn; in yarns of higher twist, the part of the curve represented may attain and reach over the point of maximum strength (See "Regularity of Single Yarns," *loc. cit.*, p.90).

Over the general range of twist, we can assume very approximately that, other things being equal, the strength is proportional to the twist. The effect of variation of the amount of fibre along a yarn is not so directly evidenced but may be deduced from the relationship between the curves TN against $t/\sqrt{N}$ for yarns of identical quality. As it has been shown, these curves are approximately straight within the limits $3 > t/\sqrt{N} > 2$ and independent of the counts. Expressed in terms of the breaking load, of portions of a yarn, this means that $T/n^{3/2}t$ is constant except for un-

Fig. I.



(*a*) 200's; (*c*) 100's, points marked ×, a separate curve is not drawn through these points as it would be indistinguishable from that of the 200's.
(*b*) 175's.
(*d*) 32's.
(*e*) 100's, curve obtained by over and undertwisting single threads.
Isolated points ⊙(*a*), ·(*b*), ⊗(*c*), ⊙(*d*), are the values of the mean $\bar{T}N$. They would lie on curves (corresponding to (*e*)) determined by twisting single threads.

usual variations. Combined with the expression $(n-a)t^2=c$, this shows that the effect on the breaking load of a variation of n is given by $\frac{n}{\sqrt{1-a/n}}$, *i.e.*, the strength of a thin portion of the yarn is proportionately greater than that of the thick places. It is this effect, combined with the drawing out of the thicker places of the roving in mule spinning, which makes it practicable to spin a yarn of moderately uniform strength by automatic drafting. These expressions, of course, do not take account of the quality or irregularities of the raw material.

(VI.) THE MEASUREMENT OF REGULARITY OF MULE YARNS.

A typical photographic test of the regularity of mule yarns, by the measurement of thickness under compression, is shown beneath the curves of Plate III. This speedy test follows, and indicates, the variations of twist and strength along the draw in a remarkable way. It also compensates, in much the same way as the tensile strengths, for variations of roving, the thin places having a higher twist which gives them a proportionately higher value both of " hardness " and strength.

All the curves agree in showing that the periodic spinning effect is most decided for the finer counts. In the 32's, only a very local increase in twist, hardness and tensile strength is found, and the minimum values are not considerably below the mean values for the yarn.

(VII.) THICKNESS OF A YARN.

The thickness of a yarn, even under slight definite tension, is a rather indefinite quantity, owing to the nature of the surface which is broken by stray hairs. The values given for this quantity were found by photography, using a magnification of about 30 diameters. Stray hairs were neglected and the thickness of the apparent solid portion estimated by callipers. This can be done fairly definitely.* The yarn was wound under a constant tension of 2 grams weight in such a way that the photograph " sampled " the yarn every $2\frac{1}{4}$in. The periods were plainly visible at the junction between the maximum and minimum twists (See Plate IV).

The length of the period corresponded exactly with that found in the regularity tester (*loc. cit.*, pp. 59—67). The values were grouped in pairs and averaged over two or three periods giving the curves shown in Plate III. The diameter also varies greatly with the number of fibres. A high number of fibres involves a low twist and gives a full yarn; a low number involves a hard twist and a thin yarn. The average values are given in Table III, and are, within the limit of error, proportional to $\sqrt{N}$. The density $p=\frac{1{\cdot}166\times10^{-3}}{D^2\ N}$, calculated on the mill-counts of 200's, 100's and 32's, is 0·66, 0·71, 0·67 respectively, the mean value being 0·68. The actual density of the yarn is probably about 0·7, which means that a little less than half the volume is occupied by cellulose.

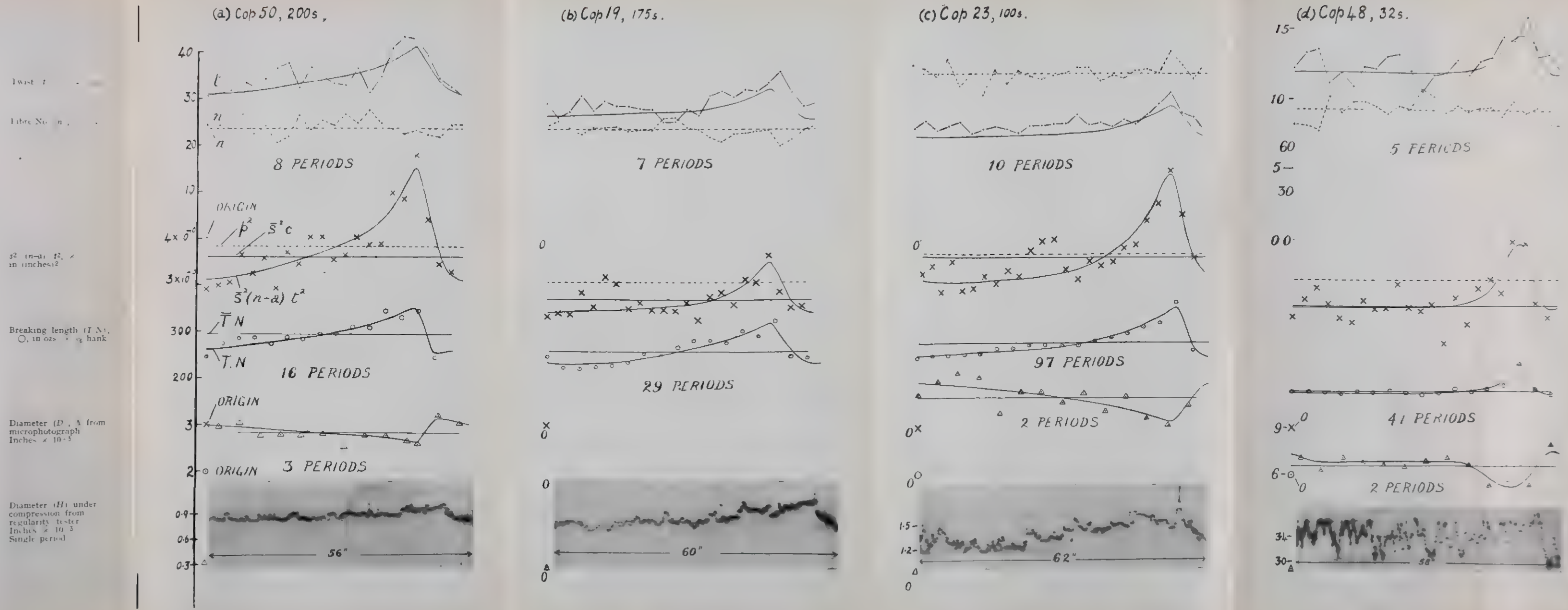
The variation of any one of the quantities represented in Plate III with any other may be qualitatively, and even approximately quantitatively, deduced from the curves given; the variation with twist from the periodic

---

* These values were checked by measuring the areas of a known length of the yarns, as photographed, by means of an Amsler's planimeter. The mean diameters by the two methods are :—

Method.	200's.	100's.	32's.
Callipers	.... $2{\cdot}83\times10^{-3}$	.... $3{\cdot}62\times10^{-3}$	.... $6{\cdot}53\times10^{-3}$ ins.
Planimeter	.... 3·19	.... 3·94	.... 8·01 ,,
Mean	.... 3·01	.... 3·78	.... 7·27 ,,

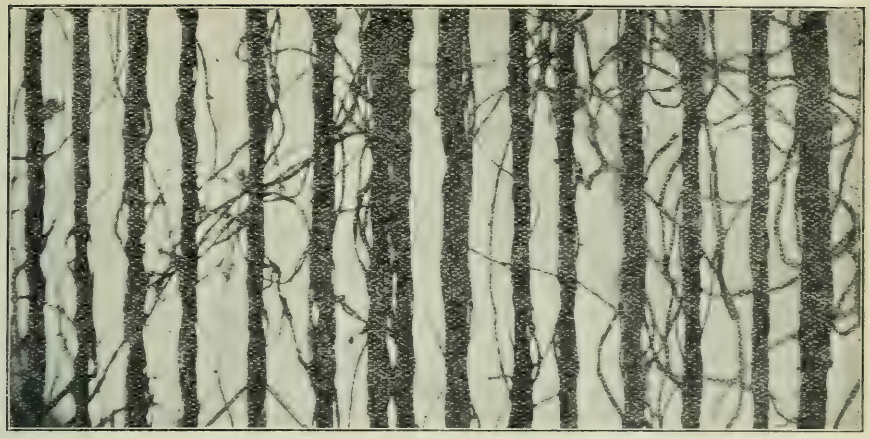
PLATE III.



Twist t
Fibre No. n
s^2 (n–a) t^2, × in (inches)^2
Breaking length (T N), ○, in ozs × $\frac{1}{16}$ hank
Diameter (D), △ from microphotograph Inches × 10⁻³
Diameter (H) under compression from regularity tester Inches × 10⁻³ Single period
(a) Cop 50, 200s.
(b) Cop 19, 175s.
(c) Cop 23, 100s.
(d) Cop 48, 32s.
t
n
n
8 PERIODS
7 PERIODS
10 PERIODS
5 PERIODS
ORIGIN
p^2
$\bar{s}^2c$
$\bar{s}^2(n-\bar{a})\,t^2$
$\bar{T}N$
T.N
16 PERIODS
29 PERIODS
97 PERIODS
41 PERIODS
ORIGIN
3 PERIODS
2 PERIODS
2 PERIODS
56"
60"
62"
58"
40
30
20
10
4×10⁻⁶
3×10⁻⁶
300
200
3
2
0·9
0·6
0·3
15
10
60
5
30
9
6
1·5
1·2
34
30

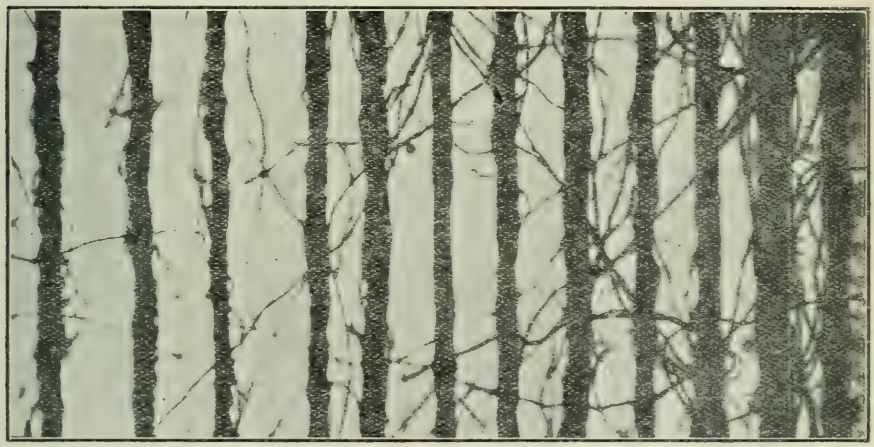
Plate IV.

200's.



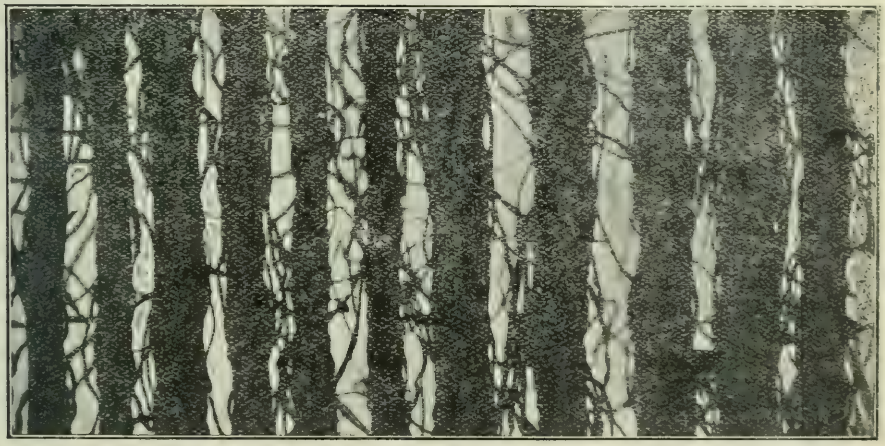
← Hard → ← Soft →

100's.



← Hard → ← Soft →

32's.



← Hard → ← Soft →

curves, and the variation with the amount of fibre or counts, by comparison of the curves for different yarns.

(VIII.) DOUBLED YARNS.

In this and the previous work on regularity, the periodicity of single mule-spun yarns has been established. Such yarns, when doubled, will possess irregular doubling twist and tensile strength, depending upon the individual irregularities of the elements of the single yarns which happen to lie side by side. If two thin elements of high twist (corresponding to the peaks of the photographs or those of the tensile strength curves) lie side by side in the doubled yarn, the doubling twist will be abnormally high and the yarn thin and abnormally strong. If two soft twisted elements of the single yarns lie side by side, the doubled yarn will be unusually full, and doubling twist low and the yarn weak. If high and low twist elements of the two single yarns lie side by side, the process of doubling will tend to give a gimp or slub effect, the resulting doubled yarn being of medium strength. In general, the operation of doubling will tend to mask the regular periodicity of the single yarns, for the singles will be laid side by side at random; but where, over a considerable stretch, the hard twisted elements of the two singles are adjacent, the irregularity of the doubled yarn will be pronounced. The undesirability of these properties, especially in knitting yarns, has been emphasised in the previous paper (*loc. cit.*, pp. 97—98). The irregularity of the doubled yarn could no doubt be obviated to some extent *by doubling single yarns which have been spun with slightly different mule draws*. If at one point two hard elements of the singles happened to lie side by side, the different lengths of the draw would ensure that this coincidence was not repeated except over a length of the doubled yarn which is considerable compared with the length of draw of each of the singles. Alternatively, the same advantage would be secured if the single yarns had *equal* draws, *providing the elements of high twist, or the elements from the points of the cops, are separated initially by half the length of a draw*. By adopting one of these devices where doubled mule yarns are used, the number of faults (which are accentuated by the subsequent finishing processes applied to the woven or knitted fabrics) would be reduced to a minimum without any modification of the mule mechanism spinning the singles.

A number of the routine computations involved in this work have been made by Mr. H. Wardle.

SUMMARY

The relationship between the local twist and number of fibres in a cross-section of a yarn is expressed by a formula with which the twists and fibre numbers of a large number of specimens are in statistical agreement. This relation is shown graphically in Plate II. The formula is generalised by taking account of the fibre cross-section, the mean value of the latter being obtained from the counts and the average number of fibres per section. The constants of the formula vary in a definite manner from count to count, and there appears to be a close correspondence with the mill-rule, viz., twist varies as √counts.

Knowing the effect of variations in fibre number, it is then possible to isolate the periodic variation of twist caused by the intermittent action of the mule mechanism. The accompanying variations in strength, visual diameter and " hardness " have been determined and are shown graphically in Plate III.

Suggestions are made to minimise or eliminate any effect due to these periodic variations when mule yarns are doubled.

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"OXYCELLULOSE": ITS FORMATION AND REACTIONS. A SUMMARY OF THE LITERATURE.

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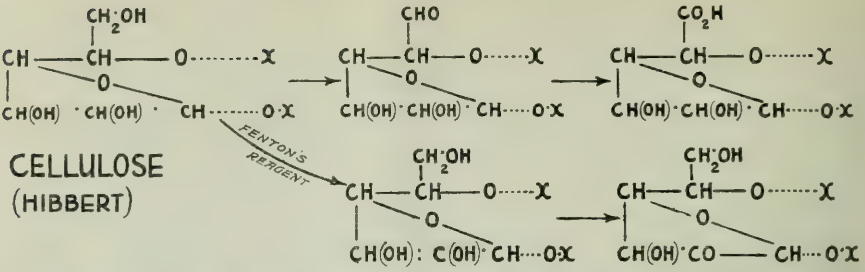
The discovery that there existed, in addition to the ultimate products of the oxidation of cellulose, intermediate substances exhibiting acidic or aldehydic properties, is generally attributed to Witz.[1] Cross and Bevan,[2] who visited his laboratory while the work was in progress, recognised the importance of his observations and proceeded to investigate the reactions involved, with the result that the term "oxycellulose" was suggested for the modified, but still highly complex products, which were further differentiated according to the extent to which oxidation was considered to have taken place. The intervening forty years have seen a succession of communications which have (*a*) dealt with the action of most of the conceivable oxidising agents, (*b*) described tests for oxidation and consequent deterioration of textile fabrics, (*c*) compared the properties and reactions of the modified products with those of normal cellulose, and (*d*) studied them in relation to the processes of bleaching,[3] mercerising,[4] dyeing and printing,[5] without, however, defining satisfactorily the complex mixture of substances known as "oxycellulose."

Some of the methods of oxidation may, and probably do, cause hydrolysis as well as oxidation, but, even when this is recognised, it is difficult to distinguish conclusively the products of either reaction. The present report is devoted, therefore, to a consideration of the oxidation of cellulose, whether the conditions admit of concurrent hydrolysis or not.

Compared with the parent substance, the intermediate products of oxidation are relatively unstable and, consequently, tend to undergo further change, the principal products being oxalic acid and carbon dioxide, although acetic acid, tartaric acid, "other unidentified C_4 and C_5 acids," saccharic acid,[7] and "soluble oxidised carbohydrates"[8] have also been recognised.

The portion normally insoluble in neutral agents is differentiated by caustic alkalis into two fractions—an insoluble portion consisting most probably of a mixture of unchanged cellulose and products with reducing properties, and a soluble portion which usually, though not necessarily, displays a reducing action also. The acidity of the products varies considerably, some dissolving in ammonium hydroxide, pyridine, piperidine or sodium carbonate,[9] whilst others dissolve only in caustic alkalis.

Bancroft and Currie[10] have stated that oxycellulose loses its power of reducing Fehling's solution on heating, and have suggested that the reducing properties are characteristic not of oxycellulose but of other degradation products. They consider that the material insoluble in sodium hydroxide (α–oxycellulose) is entirely unchanged cellulose, whilst the soluble portion (β and γ–oxycellulose) is the one substance in different degrees of aggregation. Evidence has, however, been adduced during the past few years for the presence of a primary alcoholic hydroxyl group in the cellulose molecule,[11] and this has been recognised in the two formulæ for cellulose at present most favourably received—those of Hess[12] and Hibbert.[13] The latter considers that the normal production of oxycellulose depends upon the oxidation of the primary alcoholic groupings in the complex to aldehydic or carboxylic groups, but he has also indicated a second possible point of attack by Fenton's reagent. The reactions involved are shown in the accompanying formulæ, the letter x indicating the points of attachment of the unit cellulose groups.



No attempt has been made to review the subject critically, as it is considered that this can be done more satisfactorily when work at present in progress in these laboratories is completed.

I.—METHODS OF OXIDATION.

(A) Potassium Chlorate and Hydrochloric Acid.

The action of potassium chlorate and hydrochloric acid on cellulose has been studied by Vignon[14] and other workers. Vignon treated purified cellulose with five times its weight of potassium chlorate and of hydrochloric acid ($d = 1{\cdot}18$) in boiling, dilute aqueous solution, and obtained a white powder which appeared to consist of very fine filaments under the microscope, turned yellow when heated at 100°C., reduced Fehling's solution, gave Schiff's reaction, developed a blue coloration with iodine and sulphurous (*sic*) acid more rapidly than cellulose, and dissolved partly in caustic alkalis forming a bright yellow solution. The heat of combustion was less than that of cellulose (4133 to 4124 cals. per gram as against 4244 to 4190 cals.) and the heat developed in normal sodium hydroxide solution greater (1·3 cals. per 100 grams, as against 0·74 cals. per 100 grams). By treatment with potassium hydroxide (28%) the product was separated into soluble (40%) and insoluble (60%) portions, the latter closely resembling cellulose but still reducing Fehling's solution, whilst the former was only partly reprecipitated on cautious addition of hydrochloric acid. Analyses of this product agreed closely with those of cellulose, from which it differed however by heat of formation, ability to form furfuraldehyde, a slight solubility in water, solubility in alkalis, reducing action on Fehling's solution, and reaction with Schiff's reagent. Addition of alkali or alkaline earth chlorides to the alkaline solution caused precipitation.

(B) Chromic Acid and Sulphuric Acid.

Cellulose is attacked very slowly by dilute solutions of chromic acid, but oxidation proceeds more readily in the presence of sulphuric acid. The results of oxidations carried out by Cross, Bevan and Beadle[15] at the ordinary temperature are indicated in the following table:—

Ratio available oxygen : $C_6H_{10}O_5$	Concentration of CrO_3	Yield of insoluble product ("oxycellulose")
1·5 : 1	2·1 per cent.	93·0 per cent.
3·0 : 1	3·3 ,,	87·0 ,,
5·5 : 1	4·1 ,,	82·3 ,,

The yields are expressed in terms of the starting material recovered in insoluble form. Vignon[16] realised the instability of these intermediate products and found that they were readily oxidised to soluble substances. Thus, after 48 hours in the cold, in the presence, presumably, of an excess of the oxidising agent, the remaining insoluble material amounted to 85% of the cellulose originally taken, whilst after 120 hours it had diminished to 50%, the insoluble products differing but slightly in their properties. After treatment in boiling solution for an hour, only 45% was recovered in insoluble form.

Qualitatively, the products resembled those obtained from the chlorate process.

(C) HYPOCHLORITES.

The slight reactivity of cellulose towards dilute aqueous solutions of hypochlorites forms the basis of the normal bleaching process, as these dilute solutions effectively oxidise the coloured matter in cotton. It is recognised, however[17], that two reactions are taking place, and that cotton may lose strength owing to the formation of a small proportion of modified cellulose. The tendency towards oxidation increases with the concentration of the hypochlorite solution, and the presence of carbon dioxide or sunlight, and rise of temperature[1] also exert a positive influence. The reaction is historically interesting as it was during its investigation that Witz[1] first recognised oxycellulose. Nastukoff[18], however, has examined it more thoroughly, and the following details are taken from his work:—

Weight of Cellulose.	Bleaching Powder solution				Oxycellulose (soluble in 10 % NaOH and reprecipitated by acid).
	Sp. Gr.	Volume.	Time.	Temp.	
*30 grams	1·028	1000cc.	24 hours	20°C	45%
†16 grams	1·028	1000cc.	48 hours	20°C	....
†16 grams	1·091	500cc.	48 hours	20°C	45%

* Treated twice. † Carbon dioxide bubbled through the solution. Under these conditions very little cellulose escaped attack.

The crude reaction product was in each case washed well with water, with dilute acetic acid, again with water, and treated with a litre of cold 10% sodium hydroxide. After from two hours to three days, the solution was filtered, the filtrate acidified with hydrochloric acid, and the resulting precipitate washed with water, alcohol and ether. The portion insoluble in alkali appeared to be unchanged cellulose, and, in the first of the above experiments, amounted to 30% of the original material.

The product gave the usual reactions with Fehling's solution and phenylhydrazine, but yielded only 1·1% of furfuraldehyde. From the analytical data the conclusion was drawn that one atom of oxygen had been taken up for every 4 to 6 unit cellulose groups.

Witz[1] called attention to the affinity of the portion soluble in alkalis for basic dyes and for certain inorganic compounds, notably vanadium salts.

(D) BROMINE AND CALCIUM CARBONATE.

Faber and Tollens[7] found that the oxidation of cellulose with bromine in the presence of calcium carbonate was less vigorous than when using the methods already described. Thus, using equal weights of bromine, chalk and cellulose in 7% aqueous suspension, the bromine was not absorbed completely until seven days had elapsed, even with continued shaking and warming. In later experiments, bromine equivalent to 60% of the weight of cellulose was added in separate portions over the period of oxidation. The insoluble products amounted to 85 to 90% of the cellulose initially present, reduced Fehling's solution, reacted slowly with Schiff's reagent, gave a bluish violet coloration with a solution of iodine in zinc chloride, but did not dissolve in dilute alkalis, although a yellow coloration appeared on boiling. Furfuraldehyde (1·4 to 1·8%) was obtained by distillation with hydrochloric acid. The portion of the soluble products isolated by concentration of the aqueous solution and subsequent precipitation by means of alcohol yielded salts of saccharic acid.

(E) POTASSIUM PERMANGANATE.

The conditions under which cellulose is oxidised by potassium permanganate have been investigated in considerable detail. Nastukoff[19], for example, has proceeded as indicated in the following table, the potassium permanganate being added gradually and the precipitated manganese dioxide removed from time to time by means of sulphurous acid:—

	Potassium permanganate.				Yield of oxycellulose, (sol. in 10% NaOH and repptd. by HCl).
Cellulose.	amount.	conc.	Temp.	Time.	
16 grams	11 grams	1%	20°C	—	40%
16 grams	25 grams	1%	20°C	14 days	40%
*16 grams	18 grams	—	95—100°C	—	40%

* Suspended in 1600cc. of 15% sulphuric acid.

After purification, which was effected as described under "C," all three products seemed to be identical, and, from the analytical data, appeared to have taken up two atoms of oxygen for every 4 to 6 $C_6H_{10}O_5$ units. Treatment with boiling 5% sodium hydroxide effected only partial solution and the insoluble residue neither reduced Fehling's solution nor reacted with phenylhydrazine. Knecht and Thompson[20] carried out experiments with finely pulped filter paper, oxidising it with two- or four-fifths of its weight of potassium permanganate (one or two atomic proportions of oxygen to each cellulose unit) in 20 to 30 parts of sulphuric acid (7·4%). The insoluble products, freed from adhering acid and salts and decolorised with hydrogen peroxide, were assumed to consist entirely of oxycellulose, the yields amounting to over 90% of the weight of cellulose originally taken. The less highly oxidised product possessed great affinity for basic dyes and gave a dark brown coloration with a solution of iodine in potassium iodide, which was discharged very easily by washing with cold water. It reacted with phenylhydrazine and *p*-nitrophenylhydrazine, the nature of the products varying so considerably with the conditions as to suggest adsorption and not definite combination as the cause. Reducing agents had little effect. It dissolved almost completely in sodium hydroxide, and the colourless product precipitated on acidification showed only very slight reducing properties but still had a strong affinity for methylene blue. The portion of the more highly oxidised preparation which was insoluble in caustic alkalis reduced Fehling's solution and reacted with *p*-nitrophenylhydrazine. Some evidence was also obtained of loose combination with ammonia, sodium hydrogen sulphite, hydrogen cyanide, hydrazine and hydroxylamine. In alkaline solution, cupric, ferric, and silver salts, and certain dyes were strongly reduced. More recently[89] the same authors have shown that over a range of 0 to 1 atomic proportions of oxygen to each $C_6H_{10}O_5$ unit, the "copper number" of the product is approximately proportional to the amount of oxidising agent employed.

By treating cellulose in alkaline solution at 40° to 50°C., with permanganate corresponding to 7 atomic proportions of oxygen to two $C_6H_{10}O_5$ units, Cross and Bevan[8] obtained about 50% of oxycellulose (insoluble product of the reaction) 16% of "soluble oxidised carbohydrates," 20% of oxalic acid, and also carbon dioxide and traces of volatile acids. Berl and Klaye[21] have used calcium permanganate, and Zeisel and Stritar[22] a mixture of potassium permanganate and nitric acid. Kurz[23] has suggested the use of an oxycellulose paste obtained by oxidation with permanganate in calico printing.

By treatment of an oxycellulose soluble in caustic alkalis with 5% sulphuric acid at 95-100°C, and then with 10% sodium carbonate at 70-100°C, Nastukoff[24] obtained a product ("*γ-oxycellulose*") which dissolved in water, dilute solutions being opalescent by reflected and yellow by transmitted light, whilst concentrated solutions resembled viscose or glycerol. The solubility appeared to depend upon the peptising action of the alkali carbonate. The customary reactions with Fehling's solution and phenylhydrazine were observed, and negative results were obtained with the iodine and pentosan reactions.

(F) PERSULPHATES.

By the action of ammonium persulphate and to a lesser extent potassium persulphate, Dietz[25] observed the formation of "oxycellulose," an acidic substance and traces of a peroxide. [Cross and Bevan[26] and Dorée[27] have observed the formation of peroxides by other oxidising agents.] The presence of sulphuric acid favoured the formation of the peroxide and the acidic substance, temperature also exercising a considerable effect. Thus, at 25°C, small quantities of all three components were formed, at 40°C oxycellulose and the peroxide preponderated, whilst at 65°C the chief products were the peroxide and acidic substances. Above 80°C, reaction was more vigorous, but the peroxide formed suffered immediate decomposition. The peroxide was much more stable when dry than in the moist condition.

(G) HYDROGEN PEROXIDE.

The formation of oxycellulose by means of hydrogen peroxide was first recorded by Witz[1]. Prud'homme[28] found that magnesia, zinc oxide, or cadmium oxide exercised a similar effect in the presence of oxygenated water, and attributed this to the intermediate formation of peroxides. Other writers have described the effect of air in the presence of the alkali hydroxides and carbonates[29] and the alkaline earth hydroxides[30];* whilst oxidation by hydrogen peroxide in the presence of lead[31] or of a chromium hydroxide mordant[32] has been recorded.

The effect of solutions of hydrogen peroxide on cellulose has been studied more fully by Bumcke and Wolffenstein.[33] Accepting Würster's explanation[34] of the production of reducing sugars from sucrose by the action of hydrogen peroxide, they suggested that hydrogen peroxide exercises a hydrolytic action, and designated the product "hydralcellulose." The properties described are, however, common to the oxycelluloses of other workers. Filter paper was exposed to the action of varying amounts of hydrogen peroxide of different strengths until completely disintegrated, a result requiring 19 to 90 days at the ordinary temperature. From analytical data they proposed a formula differing from that of cellulose by the addition of the elements of water to 5 to 8 $C_6H_{10}O_5$ units, but the differences are much too small to render the suggestion important. Their product failed to react with iodine, but reduced Fehling's solution and ammoniacal silver nitrate, restored the colour of Schiff's reagent, and combined with phenylhydrazine. Treatment with boiling 10% sodium hydroxide resolved it into soluble (one-third) and insoluble (two-thirds) portions, the former being designated "acid cellulose," and the latter being said to resemble cellulose closely.

Products resembling "acid cellulose" were obtained by boiling cellulose repeatedly with 30% sodium hydroxide and by acidification of solutions of cellulose in Schweitzer's reagent. All three products were non-reducing, acid in reaction to phenolphthalein, and very readily hydrolysed by acids. When dried, however, they no longer dissolved in alkalis and were more resistant to acids, a result attributed to lactone formation.

(H) OZONE.

As early as 1868, Kolb[35] exposed linen to the action of ozone and found that the cellulose was attacked and its weight increased. Witz[1] and Vignon[14] also noted the oxidising action of ozone on cellulose. More recently, the action of oxygen containing 1·4 to 2% of ozone on moist and dry cotton has been studied by Cunningham and Dorée[27] who concluded that the principal products are a cellulose peroxide (detected by liberation of iodine from a solution of potassium iodide) and an acid derivative, and that these yield a neutral product resembling the typical oxycelluloses when boiled with water. Absence of moisture was found to favour the production of the peroxide, whilst, generally, the physical condition of the cotton and its previous treatment influenced the reaction. The crude products were white, sensitive to light, acid in reaction, and to a slight extent soluble in water. Boiling 10% potassium hydroxide dissolved about 65% and apparently caused hydrolysis, as acidification produced little or no precipitation. On distillation with steam, small quantities of an acid, possibly acetic acid and an unrecognised, apparently crystalline, substance volatilised. The aqueous digest was acid in reaction, possessed powerful reducing properties and gave furfuraldehyde amounting to 3·4% of the dissolved material on distillation with hydrochloric acid. Analysis of the insoluble product agreed with that of Vignon's oxycellulose. The action of ozone on beechwood[36] and jute[27] was also studied. In a later communication,[37] Dorée showed that the properties of the peroxide were not due to retained ozone and that when it was treated with water hydrogen peroxide was liberated.

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*The formation of oxycellulose during industrial processes will be dealt with in a later report on tendering.

(J) NITRIC ACID.

The use of nitric acid led possibly to the first preparation of oxycellulose, for Mülder,[38] by the prolonged action of cold fuming nitric acid on various kinds of wood, paper, flax, etc., isolated products which he supposed to be pure cellulose, but which were in reality oxidised derivatives.[39]

By the action of boiling 60% nitric acid, Cross and Bevan[6] obtained a gelatinous product entirely soluble in dilute alkalis and reprecipitated by alcohol, acids, neutral salts and strong solutions of alkalis. About 70% of the original cellulose was oxidised to carbon dioxide and oxalic acid. When freshly prepared, the insoluble product dissolved in sulphuric acid to a pink solution, and was not coloured by iodine or Schulze's solution, but when dry it was coloured deep blue by the latter. It yielded a mononitrate with nitric and sulphuric acids. Similar products were obtained by Tollens and his collaborators[39, 40, 41], who observed the reduction of Fehling's solution, reaction with Schiff's reagent, and production of furfuraldehyde on boiling with hydrochloric acid. They investigated to some extent the acid hydrolysis of the products. The following figures are taken from the experiments of Bull,[9] Faber and Tollens[7] and Nastukoff[42] (c.f. Piest[43]) :—

Observer.	Conc. HNO_3	Ratio HNO_3 (100%) to cotton.	Temperature.	Time.	Yield (insoluble prod.).
Bull	60%	6 to 1	95°—100°C	24 hrs.....	35%
Faber & Tollens	47·5%	3·3 to 1	95°—100°C	2½hrs.	70%
Nastukoff	47·5%	1·2 to 1	95°—100°C	—	90%

Bull's product dissolved completely in aqueous solutions of ammonia, pyridine, piperidine, sodium carbonate, sodium hydroxide, or potassium hydroxide. It gave a bluish-violet coloration with Schulze's reagent, but did not reduce Fehling's solution.

Faber and Tollens found tartaric acid and other unidentified C_4 and C_5 acids amongst the products of oxidation. The oxycellulose reduced Fehling's solution strongly, dissolved in dilute alkalis and in ammonium hydroxide, and yielded furfuraldehyde on distillation with hydrochloric acid. Further treatment with nitric acid resulted in a product more readily soluble in alkalis but otherwise similar in its properties, which give dihydroxybutyric acid and saccharic acids when boiled with lime water.

The product obtained by Nastukoff dissolved completely in boiling ammonium hydroxide, and yielded a barium salt containing 5% of barium.

Vignon[44] obtained an oxycellulose by reduction of highly nitrated cellulose with ferrous chloride; whilst Knecht[45] prepared an unstable nitrate from cellulose which yielded an oxycellulose similar to that obtained by direct action of nitric acid, when heated at 100°C. in a partial vacuum.

(K) ELECTROLYTIC PREPARATION.

Oertel[46] has investigated the electrolysis of cellulose in a neutral 15% solution of potassium chloride, and reports that the material was ultimately converted completely into soluble products. When this dissolution had taken place to the extent of about 70%, the residue dissolved completely in cold 10% sodium hydroxide, and further electrolysis yielded a product which appeared to give a stable colloidal solution in water. The "copper value" of the products was high, a maximum of 39·5 being recorded, but the furfuraldehyde value remained normal. The viscosity as determined by Ost's method reached a minimum at an early stage. Compared with cellulose, the products were more readily susceptible to hydrolysis by acids and to acetylation in presence of zinc chloride, but acetolysis by Ost's method yielded 30% of crystalline cellobiose acetate whereas cellulose gave 40%.

(L) ULTRAVIOLET LIGHT.

Dorée and Dyer[47] have studied the effect of ultraviolet light on cotton fabrics, and have found that the exposed material suffers complete loss of tensile strength, dissolves in dilute solutions of sodium hydroxide, reduces Fehling's solution strongly, absorbs basic dyes, and gives a comparatively large amount of furfuraldehyde.

(M) ACTION OF HEAT.

Knecht[48] has examined the effect of prolonged heating at moderate temperatures on cotton cellulose and finds that after 336 hours at 93°C the products show distinct reactions with Fehling's solution and *p*-nitrophenylhydrazine, and, to a lesser extent, with methylene-blue and benzopurpurine.

II.—REACTIONS OF, AND TESTS FOR, OXYCELLULOSE.

The reactions of oxycellulose are, for the most part, conditioned by the presence of carbonyl or carboxyl groupings. Most of them are given by both oxycellulose and hydrocellulose, and it is therefore doubtful whether these can be distinguished satisfactorily.

(A) REACTIONS CHARACTERISTIC OF THE CARBOXYL GROUP.

(i) *Solubility in Alkalis.*—Probably the commonest test for modification in cellulose is the solubility in boiling dilute sodium hydroxide. Quantitatively, it is customary to boil the sample with 100 parts of 3% sodium hydroxide for an hour and to determine the loss in weight, so that when the loss is small the test is subject to considerable error. The effect of the concentration of the alkali and the extraction temperature on the amount of material dissolved does not appear to have been determined, though Allan[49] has indicated that a considerable variation exists. Oxycellulose may, or may not, dissolve in ammonia, sodium or potassium carbonate, pyridine, piperidine, etc., according to the mode of preparation.[9]

(ii) *Evidence of the presence of the carboxyl group.*—Schwalbe and Becker[50] have determined the acidity of a number of representative oxy- and hydro-celluloses, (*a*) by titration with N/100 sodium hydroxide, at the ordinary temperature with litmus, and at 80°C with phenolphthalein, as indicators, the figures being corrected for the alkalinity of the ash, and (*b*) by the amount of barium taken up from a baryta solution. The data, together with the other constants determined, are collected in Table I:—

TABLE I.

Results calculated on water and ash free material.

Material examined.	Copper Number.	Yield of furfuraldehyde.	" α-Cellulose."	Material resistant to baryta.	Barium taken up.	Acidity cc N/100 NaOH per gram.		Alkalinity of ash cc. N/100 HCl per gram.	Total acidity.	Microscopic appearance with 20% I—KI.	Colour with methyl Orange + NaCl.
						litmus.	phenol-phthalein 80°C				
Cellulose (cotton)	0·28	0·69%	98·85%	97·8%	0·02%	1·5	....	0·3	1·8	yellow	yellow
Oxycellulose from cotton (hypochlorite)	11·0	0·26	62·0	59·7	2·18	39·4	40·7	2·0	41·4	yellow	very bright red
Oxycellulose from wood cellulose (hypochlorite)	33·2	3·32	58·6	61·5	....	12·7	13·8	20·7	33·4	violet	red
Oxycellulose from cotton ($KMnO_4$)	8·03	1·28	61·8	65·6	1·46	27·3	27·0	0·4	27·7	yellow	very bright red
Oxycellulose from cotton (H_2O_2) ...	5·8	0·94	78·3	77·2	0·34	10·1	11·6	0·3	10·4	yellow-brown	bright red
Hydrocellulose from cotton (Girard)	3·64	1·24	83·7	75·3	0·10	3·7	4·0	0·9	4·6	yellow-violet	yellow-brown
	6·22	....	....	63·0	....	....	....	....	....	yellow-violet	yellow-brown
Hydrocellulose from cotton (Lederer)	5·67	0·76	88·45	76·3	0·17	....	....	....	....	pale violet	yellow

They suggest that the arbitrary calculation of the "copper number" on 100 grams of material soluble in baryta instead of on 100 grams of the material used, distinguishes oxycellulose from hydrocellulose. Figures illustrating this, and calculated from the numbers in Table I are as follows:—

		Copper number.
Oxycellulose from cotton,	(hypochlorite)	27·3
,, ,, ,,	(permanganate)	23·4
,, ,, ,,	(hydrogen peroxide)	25·4
Hydrocellulose	(Girard)	14·8
,,	,,	16·8
,,	(Lederer)	23·6

The last figure (for hydrocellulose prepared by Lederer's method) is not included in their table, and would seem, in view of the small number of determinations, to invalidate the conclusion.

Heuser and Stöckigt[85] state that the evolution of carbon dioxide during acid hydrolysis is characteristic of oxycellulose, and is not exhibited by hexoses, cellulose or hydrocellulose. They have employed the reaction to measure quantitatively the carboxyl content of oxycellulose. Typical figures are as follows :—

Substance.		% CO_2H.	Substance.	% CO_2H
Oxycellulose	(H_2O_2)	0·29	Cotton Cellulose	0·03
,,	($KMnO_4$)	0·65 ; 1·04	Hydrocellulose (Girard)	0·04
,,	(CrO_3)	1·32		
,,	($KClO_3$)	0·66		
,,	(HNO_3)	0·97 ; 0·83		

(B) REACTIONS CHARACTERISTIC OF THE CARBOXYL GROUP.

(i) *Phenylhydrazine, etc.*—A number of observers have examined the interaction of phenylhydrazine and oxidised cellulose and have assumed that definite chemical combination takes place. Recently, however, Knecht and Thompson[20] have suggested that the amount of the hydrazine which enters into combination varies so considerably with the experimental conditions that adsorption and not chemical combination is the underlying cause. The same writers have observed loose combination between oxycellulose prepared by the action of potassium permanganate and *p*-nitrophenylhydrazine, hydroxylamine, semicarbazide, hydrazine hydrate, sodium bisulphite, ammonia, and hydrogen cyanide. Figures indicating the extent of reaction with phenylhydrazine are incorporated in the following table:—

Observer.	Oxidant.	Percentage of phenylhydrazine fixed.
Vignon[52]	$KClO_3 + HCl$	7·94
,, ,,	$CrO_3 + H_2SO_4$	7·0
,, ,,	,,	7·7
,, ,,	,,	8·5
Nastukoff[18]	$KMnO_4 + H_2SO_4$	2·7
Bumcke & Wolffenstein[33]	H_2O_2	6·5 to 7

(ii) *Reduction Tests.*—Reduction of Fehling's solution has long been recognised as a qualitative test for modified celluloses, and Lloyd[53] has described exact conditions for its use. Berl and Klaye[21] have compared the relative reduction values of a number of oxycelluloses and suggested that these values were lowest in the case of products obtained by the action of bromine or potassium chlorate, and highest when potassium permanganate was the oxidising agent, whilst Bumcke and Wolffenstein[33] have compared the reducing power of "hydralcellulose" with glucose under identical conditions. Schwalbe[44] realised that the decomposition of oxycellulose, hydrocellulose, and cellulose itself, by boiling alkalis, did not reach a final point and therefore proposed the adoption of standard conditions in order to obtain comparable results. Figures are given in the following table:—

	Oxycellulose.		
Observer.	Source.	Agent.	"Copper Number."
Schwalbe & Becker[50]	Cotton	Hypochlorite	11·0
,, ,,	,,	Permanganate	8·0
Schwalbe[54]	Filter paper	Bleaching powder	7·9 ; 7·6
,,	Cotton	Hydrogen peroxide	5·8
Dorée[55]	,,	Ozone	14·96 ; 16·9
Oertel[46]	?	Electrolytic	39.5 (maximum)

Knecht[56] and Hägglund[84] have suggested modifications of the procedure adopted by Schwalbe.

The reduction of solutions of other metallic salts has also been described. Thus Dietz[25] observed that oxycellulose in Nessler's solution at the ordinary temperature was coloured brown at first, and then rapidly assumed a grey colour; the intensity of colour was proportional to the yellow colour obtained with alkalis.

In addition, Harrison[57] has recommended a reagent containing 1% silver nitrate, 4% sodium thiosulphate, and 4% sodium hydroxide, with which the material to be tested is boiled or steamed, the presence of oxycellulose or hydrocellulose being shown by the formation of stains. The effect is enhanced by previous treatment with a hot 1% solution of phenylhydrazine in glacial acetic acid followed by thorough washing with dilute acetic acid. Finally, Knecht[20] states that oxycellulose prepared by the action of potassium permanganate reduces ferric salts.

(C) Dyeing Tests.

The increased affinity of oxycellulose, compared with cellulose, for basic dyes was first observed by Witz,[1] who protected oxidation as a means of obtaining specialised dyeing properties[5]. The affinity for methylene-blue, in particular, has been largely used both qualitatively and, for comparative purposes, quantitatively. Nishida[58] has determined the excess of the dye by titration with titanous chloride, whilst Vignon[59], Dorée [27, 36, 37,] and others have used a colorimetric method. Kita[60], however, has impugned the quantitative value of the test, as he considers that the quantity of dye adsorbed is influenced by the degree of subdivision of the substance under examination and that there is no proportionality between the quantity of oxycellulose and the amount of methylene-blue adsorbed. Rona and Michaelis[90] consider that the mineral matter in cotton acts as an adsorbent for methylene-blue, so that this effect must be taken into account in measuring the adsorption due to oxycellulose, which often contains mineral matter introduced during the oxidation in addition to that originally present in the cotton.

Knaggs[61] has used the benzopurpurine test (devised by Knecht[62] to determine whether cotton has been mercerised) to show the presence of oxycellulose. The material under examination is washed with dilute hydrochloric acid and with water and dyed a deep shade with benzopurpurine. On further treatment with acid, the shade becomes blue, and, on rinsing in water so that the red colour on the unattacked cotton reappears, the oxycellulose remains blue-black in colour.

Scholl[63] has proposed a test with a vat dye. The sample is warmed for a few seconds in a flavanthrene "vat" obtained by boiling 0·03 gram of flavanthrene with dilute sodium hydroxide and solid sodium hyposulphite ("hydrosulphite"), washed, and exposed to the air or treated with hypochlorite to develop the colour, and the yellow product is finally boiled with 2*N*-sodium hydroxide, when the colour is again reduced to blue at a rate proportional to the reducing power of the modified cellulose. Oxycellulose becomes blue immediately. Ermen[64] has adopted the following modification of Scholl's method: A few drops of a suspension of indanthrene yellow are added to a 10% solution of sodium hydroxide and the cloth to be tested is passed through the mixture, lightly squeezed, and held in steam. Within a minute, a deep blue stain appears where oxycellulose or hydrocellulose has been formed. The rest of the cloth, if it has been properly bleached, shows no trace of blue for at least five minutes. If the cotton is washed, scoured and rubbed with soap, it is found that where reduction has taken place the dye is firmly fixed.

Everest and Hall[65] state that although cotton fabrics are normally unaffected by immersion in a solution of tetrazotised benzidine which has been made alkaline by means of sodium carbonate, a yellowish brown colour, which is fast to washing, is developed if oxycellulose is present.

Saget[66] has suggested resistance to coloration by tetrazoic dyes as a test for oxycellulose.

(D) Adsorption of Vanadium.

Witz[67] observed that oxycellulose exerted an attraction for a number of inorganic salts, in particular those of vanadium, which were withdrawn from aqueous solutions containing less than one part in a million. He demonstrated the adsorption by printing the tissue with an aniline-black mixture.

(E) Colour Reactions.

The production of a yellow colour on boiling with dilute sodium hydroxide is usually considered to be characteristic of both oxycellulose and hydrocellulose. The former alone is stated to give the colour on steaming.[72]

Jandrier[68] has recorded the following colour reactions which he considered particularly characteristic of oxycellulose prepared by the action of potassium chlorate: To a few centigrams of one of the reagents mentioned below are added 1 or 2 cc of a solution or suspension of oxycellulose, followed by 10cc of sulphuric acid, free from nitrous acid, carefully poured down the side of the tube. At the junction of the liquids, colorations are formed in the cold or on warming. Phenol gave a golden-yellow colour; α-naphthol, violet; β-naphthol, or quinol, brown; resorcinol, yellow-brown; menthol or thymol, rose tints; gallic acid, green turning to violet in the sulphuric acid; and morphine or codeine, rich violet.

Berl and Klaye[21] tested the products obtained by the use of a number of oxidising agents, and have recorded in all cases a blue coloration with iodine and zinc chloride. With iodine and sulphuric acid a blue colour resulted except when the oxidising agent was calcium permanganate (light brown), nitric acid (yellowish) and potassium chlorate (yellowish brown). Bumcke and Wolffenstein[33] record that "acid cellulose" gives no coloration with the iodine reagents.

Oxycellulose is stated to give rise to a violet dye, soluble in ether, when boiled with β-naphthoresorcinol and hydrochloric acid.[85] The product to be tested (0·2 gram) is boiled for one minute with 2cc of a 1% solution of β-naphthoresorcinol and 2cc of concentrated hydrochloric acid, with vigorous shaking, then cooled and extracted with ether, when the ether develops a reddish-violet to violet colour.

Most oxycellulose preparations restore the colour of Schiff's reagent.

Schwalbe and Becker[50] have found that when a few drops of methyl orange are added to a suspension of a strongly acid oxycellulose in water, an orange-red coloration results. The addition of a few cubic centimetres of a concentrated solution of sodium chloride changes the colour to red with oxycelluloses generally (see Table I.). Hydrocelluloses, on the other hand, fail to give the coloration, so the test has been suggested as a means of differentiation.

(F) PRODUCTION OF FURFURALDEHYDE.

It is generally considered to be characteristic of oxycellulose that a larger proportion of furfuraldehyde is formed on distillation with hydrochloric acid (*d.* 1·06) than is obtained from cellulose. The furfuraldehyde is generally estimated as the phloroglucide, the results being calculated from the tables given by Kröber.[69] Cross, Bevan and Beadle[15] appear to have been the first to study the reaction. The figures given in the following table show the variation which has been observed.

Observer.	Oxidant.	Yield of furfuraldehyde.
Vignon[14]	$KClO_3$ and HCl.	2·1%
Zanotti[70]	,, ,,	0·8%
Cross, Bevan & Beadle[15]	CrO_3 and H_2SO_4	4·1 ; 6·3 ; 8·2%
Vignon[14]	,, ,,	3·0 ; 3·1 ; 3·5%
Zanotti[70]	,, ,,	3·0%
,,	$KMnO_4$ and H_2SO_4	1·9%
Nastukoff[18]	Bleaching powder	1·1%
Haas & Tollens[39]	Nitric acid	2·6%
Faber & Tollens[7]	,, ,,	2·3%
Oertel[46]	Electrolysis in KCl	1.7%
Faber & Tollens[7]	Bromine and $CaCO_3$	1·4 ; 1·85%
Cunningham & Dorée[27]	Ozone	1·1 ; 1·5%

Although Schwalbe and Becker[50] state that the production of furfuraldehyde cannot be considered as a characteristic property of oxycellulose, and Lenze, Pleus, and Müller[87] have suggested that methylfurfuraldehyde is formed, the work of Heuser and Stöckigt[85] would appear to confirm the earlier view. Whilst the phloroglucide of furfuraldehyde is insoluble in alcohol, those of methylfurfuraldehyde and hydroxymethylfurfuraldehyde dissolve on warming.[88] The proportion of phloroglucide soluble in alcohol obtained by Heuser and Stöckigt was large in the case of hydrocellulose, lower in the case of cellulose, and much lower in that of oxycellulose, the colour reactions with resorcinol, diphenylamine, and β-naphthol indicating that the soluble portion was derived from hydroxymethylfurfuraldehyde and not methylfurfuraldehyde. The identity of furfuraldehyde was proved by conversion into the phenylhydrazone.

(G) ACTION OF HEAT.

Philip[71] has stated that after hot calendaring, yellowish to brownish stains appear when oxycellulose is present. These fade to yellow on standing.

(H) NITRIC ESTERS OF OXYCELLULOSE.

Cross and Bevan[6] prepared the mononitrate of an oxycellulose obtained by the action of nitric acid, whilst from a similar source Bull[9] isolated a product (N = 11·6 to 11·9%) the empirical formula of which approximated to that of a dinitrate. Berl and Klaye[21] have compared the nitrates obtained from a number of representative oxycelluloses by means of a nitrating acid containing 46·2% of sulphuric acid, 42% of nitric acid, 0·25% of nitric oxide, and 11·5% of water. The proportion of acid to oxycellulose was 50 to 1 and the reaction was allowed to proceed for 24 hours at 19° 20°C in each case. The products differed but little in empirical composition from a cellulose nitrate prepared under the same conditions. Their results are incorporated in the following table:—

Substance nitrated.	Nitrogen (per cent.) Nitrometer.	Nitrogen (per cent.) Dumas.	Solubility in ether-alcohol.	Fixation of methylene blue (mgr. per gram.)	Relative viscosity.
Cellulose	13·5	13·3	1·8	0·6	10,000
" Hydralcellulose "	13·2	13·4	12·1	2·4	65·7
Oxycellulose ($KMnO_4$)	13·3	—	18·0	1·6	5·15
,, (Br)	12·9	13·3	15·5	3·5	9·1
,, ($Ca(MnO_4)_2$)	13·25	—	20·5	3·3	11·1
,, (HNO_3)	12·9	13·3	34·0	5·0	7·9
,, ($KClO_3$)	13·0	-	18·0	3·0	7·2

Bumcke and Wolffenstein[33] have compared the action of nitric acid (*d* 1·48) on cellulose, " hydralcellulose " and " acid cellulose lactone." The following table gives their results, the products in each case being separated into portions soluble in alcohol and acetone respectively.

Nitration of	N. content of portion soluble in Alcohol.	N. content of portion soluble in Acetone.	Explosion pt. of portion soluble in alcohol.	Rotation of portion soluble in alcohol, in acetone solution. Conc.	Obs. Rot.
Hydralcellulose	8.8 - 8.9%	8·2%	187–189°C.	18·3%	1° 18′
Acid cellulose lactone (from Schweitzer's reagent)	—	8·2%	188–191°C.	22·6%	1° 35′
				8·8%	0° 30′
Acid cellulose lactone (from boiling NaOH)	8·1–8·3%	7·8%	184° C.	17·81%	1° 19′
				17·78%	1° 8′
Cellulose	8·6%	7·9%	191–193°C.	20·3%	1° 25′

Vignon[73] compared the nitrates obtained under the same conditions from cellulose, oxycellulose and hydrocellulose and found that all three contained the same proportion of nitrogen, though they differed in their behaviour towards Fehling's solution, potassium hydroxide ($d = 1·3$) and in the amount of furfuraldehyde isolated on distillation with acids. He concluded that the conversion of cellulose into its oxy- and hydro-derivatives was without profound effect on the molecular structure.

Piest[74] has ascribed certain abnormalities noticed in the viscosity of nitrocellulose to the presence of the esters of β-oxycellulose.

(J) Action of acetic anhydride.

The action of acetic anhydride and sulphuric acid on a number of preparations of oxycellulose has been examined by von Hardt-Stremayr[75] who used the technique described by Skraup and König,[76] and isolated α-octoacetylcellobiose in amount varying with the oxidising agent previously employed.

	Yield of octoacetylcellobiose per cent.
Cellulose	25
" Hydralcellulose "	25
Oxycellulose ($KClO_3$ and HCl)	10
Oxycellulose (HNO_3)	16

He concluded that oxycellulose contained a smaller number of cellobiose groups than cellulose. By the action of acetic anhydride in the presence of zinc chloride, Vignon and Gerin[77] obtained an acetate which resembled that isolated from cellulose under similar conditions, but retained strong reducing properties. It is described as a tetra-acetate. Oertel[46] who used an oxycellulose prepared electrolytically, and treated it in a similar manner, observed that oxycellulose was more readily esterified than cellulose and that the product dissolved more completely in acetone, the laevo-rotatory power of the solution being relatively lower. Whilst the acetates prepared from cellulose contained about 62·5% of combined acetic acid, those from oxycellulose contained 59 to 60%. Acetolysis by Ost's method[78] yielded 30-31% of crystalline cellobiose acetate, whereas comparative experiments with cellulose gave 40%. Franchimont[79] also examined the action of acetic anhydride in the presence of zinc chloride, but does not appear to have identified the product of the reaction.

(K) Appearance of the Oxidised Fibre.

According to Vetillart[89] microscopic examination shows that oxidation is accompanied by diminution in the length and width of the fibre. Permetier[81] states that the oxidised fibre does not swell like ordinary cotton when brought into contact with "cuprammonium."

(L) Acid Hydrolysis.

Vignon[59] compared the relative copper-reduction of the soluble products obtained by treating a number of celluloses, oxycelluloses and hydrocelluloses with dilute hydrochloric acid at 100°C for 6 hours. The figures obtained in the cases of oxy- and hydro-cellulose were high compared with those obtained with cellulose. Schwalbe[86] has attempted to place the reaction on a quantitative basis for purposes of comparison.

(M) Alkaline Hydrolysis.

The alkaline hydrolysis of oxycellulose has been studied by Tollens and his collaborators [7, 51] who treated the material obtained by the action of potassium chlorate and hydrochloric acid on cellulose with boiling milk of lime and isolated *iso*saccharic acid and dihydroxybutyric acid from amongst the soluble products of the reaction.

(N) Adsorption of Formaldehyde.

Beltzer[82] states that oxycellulose absorbs large quantities of formaldehyde and yields a very tough product.

(O) Adsorption of Moisture.

Although it is generally stated that the normal moisture content of oxycellulose is lower than that of cellulose, no trustworthy figures have been published. Isolated figures are given by Will[83] and by Heuser and Stöckigt[85] whose figures for a number of preparations dried in the air show a variation of from 2·6 to 8·4%.

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SOME PHYSICAL PROPERTIES OF COTTON CELLULOSE AND ITS MODIFICATIONS.

A SUMMARY OF EXISTING DATA.

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INTRODUCTORY.

The physical properties of cellulose do not appear to have formed the subject of very comprehensive enquiry. It is true that research work may have been done and not published, but the actual references in the literature are disappointingly vague and scanty. Many properties do not seem to have been studied at all, including frictional properties, compressibility, rigidity, thermal expansion, diathermancy, absorption and reflection of light, absorption of X-rays, magnetic rotation of sols and magnetic susceptibility. In the case of other properties for which data exist, the origin and treatment of the material employed are only rarely stated, and, in many instances, the cellulose must have been impure. All the information that could be gathered from a thorough search of the likely sources is summarised below, with the exception of the swelling of cellulose and the adsorption of vapour by cellulose, which subjects will be dealt with in separate summaries.

I.—THE SPECIFIC GRAVITY OF COTTON CELLULOSE.

Difficulties arising in the determination of the specific gravity, due mainly to the colloidal nature of cellulose, have been indicated by Cross[1] as follows :—" (i) Large variations of apparent density of cellulose and derivatives with different immersion liquids; (ii) large temperature variations; (iii) a general tendency to increase of specific volume in the proximate products of modification, *e.g.*, hydro- and oxy-cellulose, and hydrated celluloses." A lower limit may be set from a determination of the weight of a given gross volume of compressed cotton fibre, and typical figures[2] obtained under these conditions are: (i) In a hard pressed calendar bowl, 0·050 lb. per cu. in. ; (ii) in a mangle bowl, 0·046 lb. per cu. in. From (i) the approximate specific gravity appears to be 1·38. Several authorities give the figure 1·5 for the specific gravity of cotton or cellulose without any information as to the method of determination[3]. Of historical interest only is the determination of Kopp[4], who obtained the value 1·27 for the sp. gr. using air as the medium in his "volumenometer." All the trustworthy determinations have been made by the method involving the displacement of a given medium, and most of the data are due to Vignon[5] or de Mosenthal.[6]

Vignon's experiments were carried out at laboratory temperatures to avoid any modification of the original form by heat effects. Using the method of the hydrostatic balance and employing pure benzene as the immersion liquid, because it easily wets the fibres, he obtained " rapid, constant and accurate results," the elimination of " condensed " gases being accomplished by the use of reduced pressure (about 45 mms.) aided by the ebullition of the benzene, which was continued until the density no longer increased. The figures obtained were :—

For Cotton Wool, containing normal amount of water .... Sp. gr. = 1·50
For Spun Cotton, „ „ „ „ .... Sp. gr. = 1·51

De Mosenthal quotes several authorities [Chemiker Kalender, 1·525; Heise,[7] 1·5; Guttmann,[8] 1·5; Guttmann,[9] 1·635]. In his own determinations, Regnault pyknometers of 100 ccs. capacity were packed with about 10 grams of the dried material and filled with hot water, which was allowed to soak in and then boiled by means of an air pump. As a rule, all the air was removed at once, and only in a few instances was it necessary to assist the escape of some remaining bubbles by mechanical means. The failure of the water to rise in the neck of the pyknometer under the bell-jar of the air pump upon exhaustion or to fall when air was subsequently admitted was taken as an indication that all the air had been removed. For six different samples of dried cotton the values were identical, viz. :— Sp.Gr. = 1·607; for a sample of cotton wool, air dried, Sp.Gr. = 1·523 – 1·525; the same, oven dried at 40-50°C. for 3-4 days and then for several days over concentrated sulphuric acid, Sp.Gr. = 1·607 – 1·610. Using benzene or alcohol, values from 1·56 – 1·58 were obtained for the density with each liquid.

Cross and Bevan[10] state that the " modified " form of cellulose obtained from the xanthate has a density very similar to that of starch, for which they give the figures 1·654 and 1·650, but according to Little[11] the dense, amorphous variety so obtained has the Sp.Gr. 1·53. The powdered form of cellulose obtained by the prolonged beetling of cotton fibre has also been examined by Cross and Bevan[12]. They do not describe the method of determination of the density, though it evidently involves immersion in water or alcohol : neither do they give their figures, those in the following tables being approximate and deduced from their published graph.

Temperature °C.	26	39	44	49	64	79	90
Sp. gravity in water	1·56	1·56	1·56	1·57	1·54	1·53	1·57
„ „ alcohol	1·59	1·60	1·59	1·60	1·57	1·57	—

At about 80°C. a sudden increase in specific gravity took place and the cellulose immersed in water changed from the form of a fine powder to that of a flocculent curd, the change being reversible with temperature. Cross and Bevan consider this to be an indication of " hydration."

SUMMARY :—

MATERIAL	OBSERVER	MEDIUM EMPLOYED	SP. GRAVITY
Calendar bowl compressed cotton	Mather & Platt.	—	1·38
Cotton wool (air-dried)	Vignon.	Benzene.	1·50
Spun cotton „	„	„	1·51
Dried cotton	de Mosenthal.	(Hot) Water.	1·607
Cotton wool (oven-dried)	„ „	„ „	1·607—1·610
„ „ „ „	„ „	Benzene or alcohol.	1·56—1·58
Dense cellulose obtained from xanthate solution	Little.	Not stated.	1·53
" Powdered " cellulose obtained by beetling	Cross & Bevan.	Water. Alcohol.	1·56 at 26° C. 1.59 at 26° C.
Cellulose regenerated from Cuprammonium solution	Hassack.[13]	Benzene.	1·50

De Mosenthal has also examined (*loc. cit.*) the densities of various nitrocelluloses (containing from 10·86% to 13·5% N.), the figures ranging round 1·66.

II.—ELASTICITY.

The measurement of the elastic properties of hairs is difficult, and few trustworthy data are recorded. The following figures for cotton were recently given by Barratt[14] as the means of 200 observations each :—

	Breaking load.	Extension.
Hairs from scoured Egyptian sliver	7·2 gms.	7·4%
Hairs mercerised without tension	6.7 gms.	12·2%

The actual cross-sectional area of the walls of this kind of cotton is about $1{\cdot}4 \times 10^{-6}$ sq. cms., which gives a breaking stress of about 5×10^{9} dynes per sq. cm. and stress-strain about $0{\cdot}7 \times 10^{11}$ dynes per sq. cm. for the unmercerised cotton hair. The elasticity is very imperfect, there being considerable permanent strain. The stress-strain curve is roughly a straight line and the ratio, stress :strain at break, approximates to a Young's modulus. The recovery from strain shows a Young's modulus some three times greater. Common to all measurements on hairs is the fact that finer hairs are proportionately stronger, there being some kind of " skin " effect. This is also the case with viscose threads, the tensile elasticity of which has been investigated by Dreaper and Davis[15]. The breaking stress of monofils is of the order 3×10^{9} dynes per sq. cm. and the ratio, stress :strain at break, $0{\cdot}55 \times 10^{11}$ dynes per sq. cm. The value of the Young's modulus below the elastic limit is about three times the latter figure.

III.—SPECIFIC INDUCTIVE CAPACITY.

Campbell[16] has investigated the specific inductive capacity of regenerated cellulose. Fairly uniform and transparent sheets of viscose (0·06 – 0·3 mm. thick) were made by spreading crude 10% sodium cellulose xanthate on a glass plate, drying the film at 60°C. and salting it out with pure brine to remove soluble by-products. The cellulose was finally fixed and purified by treatment with acid and thorough washing, and the sheets were dried at 80-110°C. for several days, which made them very brittle. The following results were obtained :—

Temperature °C.	20	25	30	40	50	60	65	70
Specific inductive capacity	6·7	—	6·8	7·0	7·2	7·3	—	7·5
Resistivity (megohm. cm.) $\times 10^{-6}$	—	1600	900	330	125	40	20	—

The " air-dry " cellulose (containing water) exhibited somewhat lower resistivity. The apparent dielectric strength (max. volt./thickness in cm.) of the cellulose sheets varied with the thickness, but for air-dry cellulose it was of the order of 250,000 volts per cm., and for oven-dry cellulose approximately 500,000 volts per cm. Campbell also gives the following figures for solid cellulose acetate :—Specific inductive capacity, (*a*) air dry, 4·7; (*b*) oven dry, 3·9; temperature variation about 1% for 40°C.; apparent resistivity, (*a*) air dry at 16·5°C., 200 Mega-megohm. cm.; (*b*) oven dry at 26°C., over 9,000 Mega-megohm. cm.

The value of the dielectric constant is 6·7 according to Landolt Bôrnstein,[17] whilst the figure 1·1 has also been given.[18] Reference should also be made to recent papers by Bultemann[19] and Fleming and Monkhouse[20].

IV.—ELECTRIFICATION.

Textile materials, particularly when dry, frequently become electrically charged during processes involving friction, and the removal of this difficulty in technical operations has been the subject of various patents[21]. Shorter[22] has shown that electrification difficulties can be avoided by keeping the materials sufficiently moist. Thus with cotton at 70°C.—80°C., a relative humidity of 62% is suitable for the processes preparatory to spinning, whilst in spinning 70% humidity is generally sufficient to counteract electrical effects, but as this introduces other troubles, 50% humidity is preferable.

Dobson[23] gives some details of such electrification in mill processes.

Gee and Harrison[24] and Harrison[25] have investigated the potential difference between cotton and various liquids, their method of investigation being to determine the potential difference produced on forcing the liquid by mechanical pressure at a known rate through a quantity of cotton. By calculation from an appropriate formula, the average value for the contact difference between water and cotton is found to be 0·06 volts, whilst with mercerised cotton the value is lower.

The potential differences between cotton and the various 0·001*N* solutions named below are given as follows :—

Diamine-blue 2B	0·0287 volts.	Sodium hydroxide....	0·0306 volts.
Trisodium phosphate	0·0240 ,,	Magnesium sulphate	0·0136 ,,
Sodium sulphate	0·0219 ,,	Hydrochloric acid....	0·0085 ,,
Sodium chloride	0·0183 ,,	Aluminium sulphate	0·0036 ,,

The potential difference between 0·001*N* sodium chloride and cotton after various treatments is given in the following table :—

	Contact difference in volts.		Contact difference in volts.
Untreated cotton	0·0272	Cotton mercerised without tension and dried	0·0195
Nitrated cotton	0·0502	The same wet	0·0101
Cotton mercerised under tension and dried	0·0261	Cotton mercerised with nitric acid	0·0094
Cotton treated with 40°Tw. NaOH and extracted with alcohol	0·0214.		

Perrin[26] and Des Bancels[26a] had previously carried out similar experiments.

Burton[27] has stated that under the action of a potential difference cotton travels to the anode when suspended in water, but to the cathode in turpentine, and Gee and Harrison (*loc. cit*) have observed that nitrocellulose suspended in aqueous acetone likewise travels to the anode.

According to Darling[28] moist cellulose conducts electricity, and a latent image of the cathode is produced in the cellulose. The action of an electric current on moist viscose fibres in order to produce a greater lustre and better handle has been protected (Hartog[29]).

V.—MECHANICAL ABSORPTION OF LIQUIDS.

Vignon[30] investigated the comparative absorption of liquids by textiles, and found that after simple draining by gravity 100 parts of cotton retained the following parts by weight of liquid :—

Water	497	NH_3 Aq. 2%	509
Alcohol, 93%	514	NaCl Aq. 9%	522
Benzene	506	,, 17·5%	551
HCl Aq., 3.5%	482	,, 26·0%	580

Drabble has shown[31] that the well-teased fibres separated from cotton seeds possess a water-retaining capacity almost as great as that of the best cotton wool.

VI.—THERMAL EFFECTS ACCOMPANYING WATER ADSORPTION.

Beadle and Dahl[32] investigated the increase of temperature which ensues when anhydrous cellulose is exposed to atmospheric moisture, and found that pulverised cotton wool, the fibres of which were only one-twentieth part of the ordinary length, and fine viscoid, gained less water than cotton wool and coarse viscoid respectively, but that the former reached equilibrium sooner. Different temperature curves were obtained for each substance. Masson[33] has also examined the thermal effects consequent on wetting dry cotton or exposing it to aqueous vapour. Katz[34] using dried filter paper gives figures for the heat of water adsorption which he terms the "heat of swelling." This varies with the amount of moisture present in the paper, and is 10·7 cal. per gm. for dry material. Rosenbohm[35] gives the "heat of swelling" of three varieties of dried cellulose as follows :—Filter paper 9·6, "pure cellulose" from wood 12·9, and cotton 20·8 cal. per gm. Barratt and Lewis[36] find that 3·6 cal. per gm. are liberated from Egyptian sliver containing 5·1% water.

VII.—CHANGES RESULTING FROM THE ACTION OF HEAT AND COLD.

In the manufacture of filter paper[37], freezing of the wet sheets is sometimes carried out to effect a disruption of the cotton material, although freezing in ice is said not to cause tendering[38]. When heated, cotton first loses adsorbed moisture, no appreciable decomposition occurring below 130°C., at which point water begins to be given off again[39], increasing in amount with rise in temperature. This water comes from actual decomposition of the cellulose, and is not regained on cooling the cotton and exposing it to the air. The exact temperature at which decomposition begins is uncertain, but is usually supposed to be near 150°C.[40]

VIII.—THERMAL CONDUCTIVITY.

Forbes[41] investigated the heat conductivity below 0°C. of divided and pressed cotton wool, his figures converted into absolute conductivity units (Cal./cm.sec., temp.cent.) being $K = 0{\cdot}0000433$ and $0{\cdot}0000335$, respectively. These values indicate that the heat conductivity of cotton is of the same order as that of air. Schuhmeister, however,[42] using Stefan's method for gases, concluded that the heat conductivity of cotton is 37 times that of air, whilst the value $K = 0{\cdot}000152$ at 50°C. was given by Nusselt.[43] Recently the comparative conductivities of knitted and woven cotton, woollen, linen, and silk materials have been measured by Emily Rood[44] by the disc method of Lees, and the various factors affecting the conductivity are discussed in her report.

IX.—SPECIFIC HEAT.

Fleury[45] using dry filter paper, almost free from ash, with turpentine as the calorimetric liquid, obtained as a mean of ten determinations the results :—

Sp. heat. dry cellulose = 0·366; ordinary cellulose $(7\% H_2O) = 0{\cdot}41$.

Dietz[46] determined the mean specific heat between 0° and 100°C. to be 0·319, whilst Padoa[47] obtained the value 0·347.

X.—HEAT OF COMBUSTION.

The information available is summarised in the following table (See also Binder[48]) :—

MATERIAL USED	OBSERVERS	CONDITIONS OF EXPERIMENT	HEAT OF COMBUSTION CALS. PER GRAM
Purified Cotton	Gottlieb[49]	In oxygen (mean of 4 results)	4155
Dry Cotton	Berthelot & Vieille*[50]	In compressed oxygen	4209
Purified Cotton	Stohmann & Langbein*[51]	do.	4188·0
Cellulose	Berthelot*[52] quoted by Rechenberg (l.c.)	do.	4142
" Viscosed " filter paper	Rechenberg [53]	With cane sugar	4452
Purified filter paper	Stohmann[54]	With potass. chlorate	4146
Cotton and filter paper	Stohmann & Langbein[51]	(Mean of 11 results)	4185·4

—continued

MATERIAL USED	OBSERVERS	CONDITIONS OF EXPERIMENT	HEAT OF COMBUSTION CALS. PER GRAM
Cotton wool	Vignon[55]		4244–4190
$HCl-KClO_3$ oxycellulose	Vignon		4133–4124
Do.–residue after potash extraction	do.		4201
Product pptd. by acids from potash extract of above	do.		3929
Cotton cellulose (dried at 100 C)	do.		4223
Hydrocellulose (dried)	do.		4006
Mercerised cellulose (dried)	do.		3980
Cellulose regenerated from cuprammonium	do.		3982

* These authors have also calculated the heat of formation from the elements.

XI.—HEAT OF REACTION.

Vignon[56] has investigated the heat of reaction of cotton with sodium and potassium hydroxides and hydrochloric and sulphuric acids, the material being dried, weighed, and allowed to attain moisture equilibrium in the atmosphere before use in the experiments. The results calculated on dry material round about 11°—12°C. are as follows :—

Reagent.	Unbleached cotton, spun. per gram.	Bleached cotton wool. per gram.
N.KOH aq.	0·8 cal.	1·40 cal.
N.NaOH aq.	0·65 ,,	1·35 ,,
N.HCl aq.	0·40 ,,	0·40 ,,
$N.H_2SO_4$ aq.	0·38 ,,	0·36 ,,

Bleached cotton thus liberates more heat with alkalis than non-bleached, and Vignon attributes this to the formation of oxycellulose in bleaching. The same experimenter found[55] that at 13°C., using 10 grms. of substance and 500 ccs. of potassium hydroxide, "cellulose" (cotton wool) liberated 0·74 cal. per gm. material, and "oxycellulose" ($HCl-KClO_3$ product) liberated 1·30 cal. per gm. More recently Barratt and Lewis[36] have determined the heat of reaction of caustic soda solutions and Egyptian sliver containing 5·1% water.

XII.—REFRACTIVE INDEX.

De Mosenthal[6] has examined the refractive index of nitrocellulose and cellulose recovered from this. Acetone solutions of nitrocellulose did not give concordant results in the Pulfrich refractometer, and therefore thin films (0·02 – 0·03 mm.) were examined in the Abbé refractometer. A table is given showing that nitrocelluloses containing over 12·95% nitrogen differ from the others for which the value of n_D is always about 1·514.

With denitrated films the values varied from 1·5287 to 1·5310, the latter figure being given by the thinnest and probably most efficiently denitrated film, so that de Mosenthal takes for cellulose the value $n_D = 1{\cdot}5310$. This was confirmed by immersing a cotton hair in a mixture of monobromonaphthalene and carbon tetrachloride having this refractive index, when the cotton was almost invisible. Calculating the molecular refraction from the formulæ

$$r = \frac{n-1}{d} \cdot M \quad \text{and} \quad R = \frac{n^2-1}{n^2+2} \cdot \frac{M}{D}$$

the following values are obtained :—

	M.W.	D.	n_D.	r	R
Cellulose	162	1·61	1·5310	53·5	31·15
Dinitro cellulose	252	1·67	1·5410	77·6	45·46

Herzog[57] gives the refractive index of certain artificial silks as follows :—

Fibre.	n_{D}^{17}		Difference.
	Plane of Polarisation.		
	Perpendicular	Parallel	
	to the longitudinal axis of the fibre.		
Chardonnet silk	1·548	1·515	0·033
Vivier silk	1·547	1·521	0·026
Lehner silk	1·549	1·515	0·034
Cuprammonium silk	1·548	1·527	0·021
Viscose silk	1·548	1·524	0·024

XIII.—DOUBLE REFRACTION AND APPEARANCE IN POLARISED LIGHT.

Under the microscope, between crossed nicols, the raw cotton hair appears bright and coloured, indicating double refraction [[58-63]; immature hairs[64]], though Behrens[65] states that this double refraction is weaker than that of all the other fibres which he examined. Haller has shown that immature hairs are isotropic in behaviour under polarised light,[61] and the same is said of Fort's cellulose powder.[12]

The double refraction is generally explained by the presence of internal strains, and Harrison considers[58] that the presence of strain lines running parallel to the axis of the hair would satisfactorily account for some of the optical phenomena observed. The effects of both the naturally and artificially produced strains can be made to disappear. For example, during mercerisation, the cotton hair is softened and the internal strains are released with the change in shape of the hair; whilst, if mercerised under tension, new strain lines are set up. Artificially produced strains are also readily removed by immersion in water or more slowly by exposure to a damp atmosphere. In the swelling of ordinary cotton hairs by Schweitzer's reagent, the swollen barrel-shaped formations do not give evidence of any optical activity, the strains having been released by the softening of the hair, whereas the narrow bands between these swollen portions appear quite bright. Artificial silk fibres, made by forcing cellulose solutions into a coagulating liquid, show double refraction quite strongly after drying under slight tension. Herzog,[63] working before Harrison, had already shown that mercerisation produces anomalous effects in regard to double refraction, and he also stated that, after swelling in cuprammonium, bright bands may be seen occasionally on the hair. Likewise Cramer,[66] in 1858, had also shown very clearly the changes which swelling in cuprammonium brings about on the behaviour of the hair towards polarised light.

The examination of nitrocelluloses by polarised light under the microscope has been recommended by Bowman as a test for the extent of nitration for technical purposes.[4] De Mosenthal[62] states that nitrated cotton hairs do not show such brilliant interference colours as ordinary cotton hairs, and the relations between the degree of nitration and double refraction has also been examined by Ambronn.[67]

XIV.—ACTION OF ULTRAVIOLET LIGHT.

Ultraviolet light has a pronounced action on cotton products, causing decomposition and tendering[68-71]. The short waves are absorbed and transformed into light of a greater wave length, so that cellulose is rendered visible in a dark room when a beam of ultraviolet light is thrown upon it. This luminescence or fluorescence has been studied by Ambronn[67] and by S. Judd Lewis.[72] Ambronn has shown that on nitration the intensity of the luminescence is reduced with increasing nitrogen content, whilst quantitative relationships between the intensities produced with various cellulosic materials at different wave lengths have been established by Judd Lewis by photographic methods. Various modified forms of cellulose do not behave exactly alike; thus normal cellulose and viscose fall in different classes. Cellulose nitrates are nearly, if not quite, inactive, but the cellulose acetates exhibit a very strong fluorescence.

De Mosenthal[73] concludes that, since both cellulose acetate and nitrate in solution selectively absorb ultraviolet light, it can be stated that the cellulose group absorbs ultraviolet light. The older literature on this subject is summarised by Schwalbe.[74]

XV.—OPTICAL ACTIVITY OF SOLS.

The question of the optical activity of solutions of cellulose in Schweitzer's reagent was the subject of a controversy between Levallois[75] and Béchamp,[76] the former affirming that cellulose possesses a real lævo-rotation, whilst the latter maintained that cellulose itself is optically inactive and that any rotation is to be ascribed to the molecular transformation resulting from the action of the reagents employed. This seemed to be confirmed by the fact that the solution of cellulose in concentrated hydrochloric acid is inactive.[77] Recently,[78] however, the question has been re-opened by Hess and Messner, who have obtained the following figures, which are in close agreement with those of Levallois :—

COMPOSITION OF SOL IN 100 CCS.			ROTATION	
Ammonia.	Copper.	Cellulose.	$l = 0{\cdot}2$ *dm*	(α)
12%	0·6 grms.	0·4 grms.	– 0·8°	– 950°
24%	1·0 ,,	1·0 ,,	– 1·9°	– 1000°

They state that the following solutions are inactive :—Regenerated cellulose in concentrated hydrochloric acid; ethereal solutions of ethylcellulose; aqueous-alkali solutions of cellulose xanthate; gelated cellulose in neutral salt solutions. They also suggest a "latent asymmetry" in the molecular structure such as is met with in the case of mannitol, and believe that the rotation is caused by the presence of a copper-ammonia "celluxose" complex[79] in the solution, the constitution being explained on the Werner valency theory.

Guignet's sol[80] is said to be feebly dextrorotatory, but Allen[81] states that a 1% solution of cellulose in Schweitzer's reagent possesses lævo-rotation. De Mosenthal has shown that solutions of nitrocellulose in ethyl acetate or acetone are dextrorotatory, and assumes that this proves the activity of cellulose itself. According to Mulder,[82] zinc-ammonium sols of cellulose are optically inactive, whilst Vignon[83] noted a somewhat doubtful, weak, dextro-rotation in the case of a "cellulose thiocarbonate" sol.

XVI.—ULTRAMICROSCOPY

The ultramicroscopic examination[68] of cotton indicates a general turbidity throughout the hair and numbers of bright points. From this Harrison concludes that the hairs are not physically homogeneous, though the spaces between the solid cellulose are certainly less than 10^{-5}cm. in diameter, and are presumably pores. Mercerising increases the fineness of the structure, this statement not being inconsistent with the conclusion of Haller[84] drawn from a similar evidence that in the mercerised fibre the micelles are more widely separated than in the ordinary cotton fibre.

Gaidukov[85] as a result of ultramicroscopic observations on cotton concludes that it consists of a collection of relatively large and irregularly distributed micelles (c.f. Nägeli's theory), whilst Herzog[63] considers from similar evidence that some regular arrangement of the micelles exists in the fibre. Herzog[57] states that, viewed by the ultramicroscope, cuprammonium silk shows a mesh structure, while viscose silk only shows coarse, weakly-illuminated compartments along its length.

XVII.—EVIDENCE OF X-RAYS ON STRUCTURE.

Scherrer,[86] who first investigated cellulose by the Debye-Scherrer method, was unable to find any trace of interference rings. More recently, Herzog and Jancke[87] claim that cotton cellulose possesses a rhombic crystal structure with an axial ratio of 0·6935 :1 :0·4467. By using a bundle of parallel hairs, point figures are obtained instead of the ordinary interference rings. Artificial silk fibres likewise possess a crystal structure, though in both cases (general and parallel fibre bundle) rings are obtained. Artificial silk from cellulose acetate appears amorphous. It has been calculated on this somewhat meagre evidence that in the case of cellulose the elementary body has the dimensions 7·9 by 8·45 by 10·2 by 10^{-8}cm., and that there are therefore four $C_6H_{10}O_5$ units in the cellulose molecule.

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A STUDY OF FLAX AND KINDRED FIBRES.

II.—FURTHER OBSERVATIONS ON FLAX (AND COTTON) FIBRES. PROBABLE RELATIONSHIP BETWEEN "STOMATA" AND "SLOW SPIRALS" OF COTTON AND "DISLOCATION MARKS" OF FLAX.*

By C. R. Nodder, B.A. (The Linen Industry Research Association).

There are visible in the cotton hair, usually if not always, certain structures which have been photographed by de Mosenthal[1] and by Balls[2] and named by them " Stomata " and " Slow Spirals " respectively. These structures do not form a striking feature of the fibre, and unless specially looked for are likely to pass unnoticed; they have, indeed, attracted little attention. Careful drawings of cotton hairs in which such structures are visible are reproduced in Figs. 1, 2 and 3; the fibres were mounted in water and were unstained. It is proposed to show that the " slow spirals " are

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[*] This communication has been released by the Linen Industry Research Association for publication as that Association's Research Institute Memoir No. 9.

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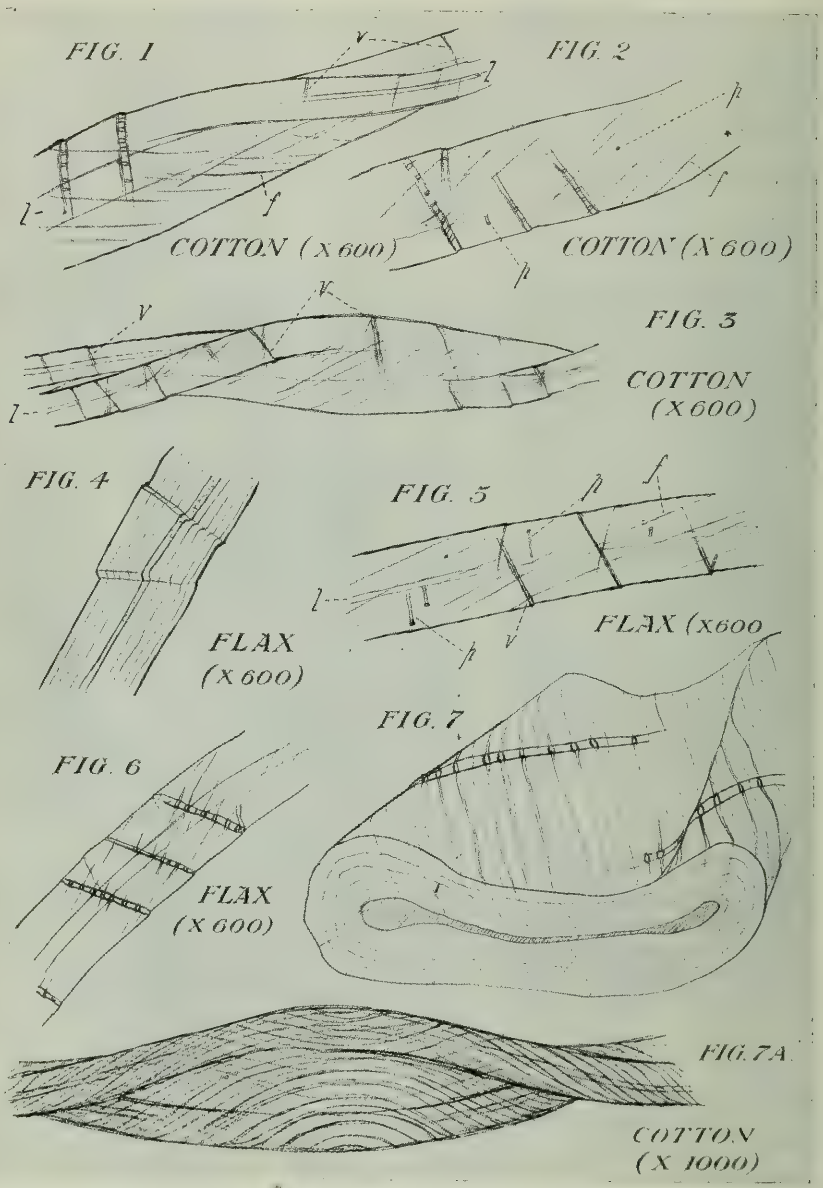
FIG. 1
v
l
l
f
COTTON (x 600)
FIG. 2
p
f
p
COTTON (X 600)
v
v
l
FIG. 3
COTTON
(X 600)
FIG. 4
FLAX
(X 600)
FIG. 5
p
f
l
v
p
FLAX (x600
FIG. 6
FLAX
(X 600)
FIG. 7
FIG. 7A.
COTTON
(X 1000)

PLATE I.

closely analogous to structures which are of general occurrence in flax and numerous other fibres, namely, the " dislocation marks " (*verschiebungen* of Von Höhnel). It is necessary here to refer to the question recently raised by Robinson[3] as to the existence of transverse markings (*verschiebungen*) in the cotton hair. An examination of bleached cotton fibres from various sources has convinced the writer that such markings are undoubtedly to be found quite generally in cotton (Fig. 3), although they are far less prominent than those which occur in flax, for example.

Robinson[4] has suggested that the transverse markings of flax are in reality slip planes such as he has found to be produced in the walls of wood-cells when pressure is applied.[5] Reimers[6] suggests that these markings are due to the production by mechanical action of a " reorientation of the micelles," and that they are therefore comparable with the twinning produced in calcite by pressure. It is doubtful if actual shearing occurs in the production of typical dislocation marks. In those fibres which show up clearly (in optical section) the lamellæ composing the cell-wall the characteristic appearance of these cross-markings is such as is shown in Fig. 4. There is no discontinuity in the lamellæ, but merely a sharp change in direction. The writer, therefore, finds himself in agreement with the suggestion of Reimers, and indeed had arrived independently at practically the same conclusion, *i.e.*, that the fibre may be regarded as a crystal in which the fibrils[7] play the part of molecules and that the dislocation marks may be compared with the twinning produced in calcite crystals by pressure. One must not disregard the fact, however, that further evidence will have to be brought forward to substantiate this view. The cross-markings which occur in cotton fibres show no essential difference from those of flax and similar fibres. In both cases, the markings stain a deeper brown on treatment with iodine and a purplish colour is produced in them by subsequent treatment with sulphuric acid of a strength 95-100°Tw. which produces practically no change in the colour of the rest of the fibre. The different staining reaction with iodine is not accounted for by the " twinning " hypothesis alone; a further change of the nature of depolymerisation has probably occurred in the vicinity of the dislocation marks, and the writer believes that this may consist simply in the local lateral separation of the ultimate fibrils of which the cell-wall is composed. If one regards these fine fibrils as constituting at the same time the cellulose molecules and also the ultimate particles of the cellulose colloid,[8] it will be seen that such a change may be regarded either as a depolymerisation or as an increase in dispersion of the colloid. It may be mentioned in this connection, as was recorded in a previous communication, that a fibre (flax, cotton, etc.) when mounted in a suitable iodine solution and compressed beneath the coverslip, takes on a purplish colouration and has at the same time its fibrillar structure clearly displayed; an increase in the pressure on the coverslip causes an intensification of the purple colouration and an increase in the fineness of the fibrils which are visible.

In both cotton and flax, a given dislocation mark often extends for only a part of the width of the fibre (Figs. 3 and 5). In cases where a cross-like appearance is seen (Figs. 3 and 5) it is often found by careful focussing that one part of the cross lies on the upper side of the fibre and the other on the lower. Since, as has been previously noted, the transverse markings lie approximately at right angles to the trend of the fibrils, the former often appear to form parts of spirals having an opposite direction

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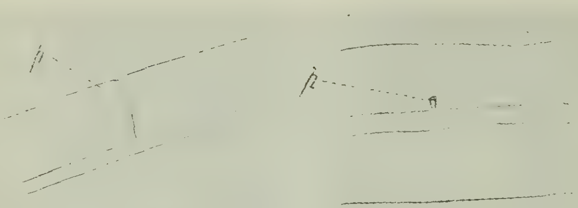

FIGS 8 & 9

COTTON

(480)

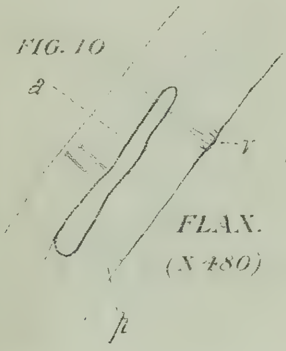

FIG. 10

FLAX.

(X 480)

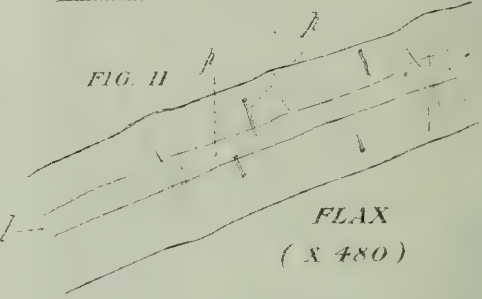

FIG. 11

FLAX

(X 480)

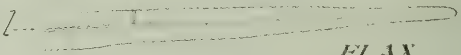

FIG. 12

FLAX

(X1000)

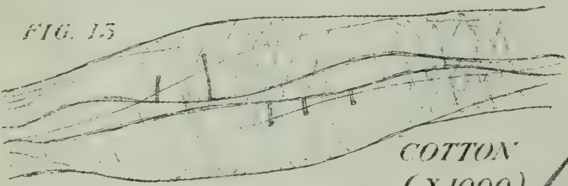

FIG. 13

COTTON

(X1000)

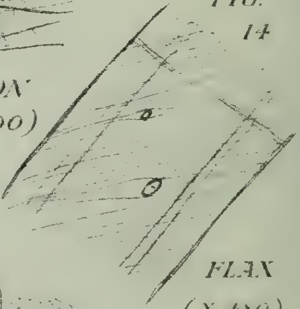

FIG. 14

FLAX

(X 480)

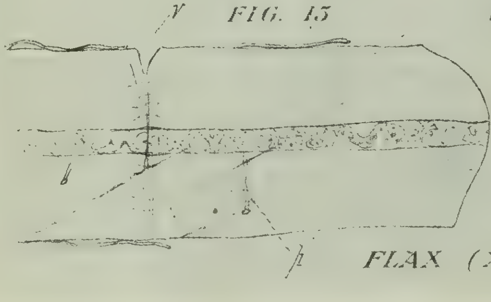

FIG. 15

FLAX (X1000)

PLATE II.

of twist to that of the latter (Fig. 5). This observation is of interest in connection with the statement of Balls that the " slow spirals " of cotton frequently (although apparently not always) have a reverse direction of twist to that of the fibrils.

In Fig. 7, an attempt has been made to illustrate the writer's interpretation of the " stomata " of de Mosenthal. The view is put forward that these structures are due to the formation of gaps or slits between the fibrils of the cell-wall where the dislocation marks occur. In a number of unusually good examples, it has been quite clear that the structures are of the nature suggested, and great support is lent to this view by the fact that flax fibres often present an almost identical appearance of oblique rows of " stomata," but here the nature of the structures is much more evident and their association with the dislocation marks is undoubted (Fig. 6), and here also the fissures between the fibrils often extend for some distance on either side of the transverse markings; cotton fibres, too, occasionally show the latter character. In typical cases, a " step " is seen in the contour of the cell-wall where transverse markings occur (Figs, 1, 2) both in cotton and in bast fibres. Unfortunately, De Mosenthal's photographs have apparently been trimmed, for purposes of reproduction, right up to the outline of the fibre, and the " step " has been lost in the process. In further support of the correctness of the present view, it is to be noted that in cotton fibres dislocation marks often occur in which no " stomata " are to be seen, although they are otherwise perfectly similar; this condition is in fact the more usual (Fig. 3).

The actual development of a dislocation mark seems never to have been observed through a microscope. The writer is of the opinion that the most common mode of origin (in flax and other " bast " fibres) is by the bending of the fibres *while still in bundle form*, an action which takes place, for instance, during growth, breaking, and when under the scutching blade. The restraint which is imposed by the intimate association of the fibres in a fibre-bundle is likely to favour the production of dislocation marks by a bending action which in the case of isolated fibres would produce no such effect, as the elastic properties of the fibre would have freer play. The distribution of the dislocation marks in a fibre-bundle supports the view (see, for example, W. Müller's diagrams, Faserforschung, No. 1, 1921, p. 1). The less prominent appearance of the cotton markings may be connected with the fact that cotton fibres do not occur in bundle form; whether the markings are produced in the boll or at a later stage remains to be determined. When cotton and flax fibres are moistened, they contract in length; if the moistening takes place when the fibres are in the form of a yarn, it is conceivable that, on drying, there may be a resistance to the tendency of the fibres to elongate again. Such a resistance may result in the production of transverse markings, and if this is the case the phenomenon would have no doubt an important connection with the shrinking of fabrics.

One cannot help being impressed by the remarkable similarity that exists between the cotton hair and the flax fibre (as an example of numerous " bast " fibres which are among themselves very similar in structure). The existence of an apparently almost identical fibrillar structure* in the two cases, and the great similarity of the dislocation marks in structures which are not homologous, seem to point to the conclusion that the properties of cellulose itself largely determine the architecture of the fibres. This view is in harmony with the assumption that the fibrils are the cellulose molecules.

The cell-wall, both of the cotton hair and of " bast " fibres, undoubtedly increases in thickness by the deposition of successive layers of cellulosic material. The mode of increase in girth is more open to question, but, since it is now quite clear that the cell-wall is made up of minute fibrils spirally arranged, it seems very probable indeed that this increase is attained by the insertion of new fibrils between, and parallel to, the pre-existing fibrils. The alternative possibility that the individual fibrils merely increase in thickness without increasing in number seems less probable to the writer from a consideration of the dimensions of the finest visible fibrils which are to be seen in flax fibres of various sizes and from various sources when treated by the compression method previously described. These fine fibrils seem to be of a fairly uniform size.

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* The cotton hair differs in showing twist reversals, concerning even the proximate cause of which there is still great obscurity.

The Existence of Pores in the Flax Fibre and the Cotton Hair.—It is curious that descriptions of the flax fibre, in every case as far as the writer is aware, omit all mention of the minute pores which may be seen in the cell-wall in a large number of cases.* These are illustrated in Figs. 5, 10, 12, 14 and 15. They pass, in typical cases, from the lumen to the exterior of the fibre, sometimes pursuing an oblique and sometimes a rather sinuous course. In some fibres such pores do not seem to be visible, but when they occur they are usually present in considerable numbers, and the cases illustrated are characteristic as regards their number and mode of distribution. The diameter of the pores varies from about 2 μ down to a size so small as to be only just visible. This being so, it seems possible that other pores may be existent but beyond the limit of visibility. Further, in the case of fibres in which pores appear to be absent, there is the possibility that they are really present though of ultramicroscopic size. The pores described are, presumably, the means by which protoplasmic continuity is secured from fibre to fibre. In this connection, it is interesting to recall that Tammes has shown that the increase in length of flax fibres does not take place by a *sliding* growth. It is conceivable that the pores play a part in the increase in girth of the fibre by the insertion or intercalation of new fibrils. De Mosenthal (*loc. cit.*) refers to both pores and " stomata " in cotton fibres, but, to the writer, it is not clear from his description or figures what distinction he draws between them. A careful examination of cotton fibres has led to the rather unexpected result that pores or pits in the cell-wall were found to be visible in numerous instances; these pores were extraordinarily similar in size and in general appearance to the pores which exist in flax fibres (Figs. 2, 8, 9, 13). Some cotton fibres were apparently devoid of such pores; here, again, it seems very probable to the writer that they are really present, although of ultramicroscopic dimensions, since pores have been seen, as in flax, the size of which was practically at the limit of visibility. The presence of pores in the cotton hair is, of course, not without a parallel, since pores or pits are of frequent occurrence in the outer wall of the epidermis of plants. The possibility naturally suggests itself that the pits play a part in the growth of the cell-wall; they may assist in the insertion of new fibrils between the pre-existing ones by supplying a passage for the materials necessary for the formation and deposition of cellulose. The existence of pores in cotton and flax fibres (and doubtless in other bast fibres) is of interest and importance in connection with problems of dyeing.

The Reversal of Twist in the Cotton Hair.—A few cases have been encountered in which the course of the fibrils in cotton fibres was clearly visible in the regions of twist reversal. This is illustrated in Fig. 7A; the fibre was mounted simply in water. A similar appearance was found in bleached cotton from various sources. It is clear that where the fibre as a whole has a right-handed twist, more or less cork-screw-like, the fibrils run in right-handed spirals, and *vice versa* (Fig. 7A). This is true also in the cases of flax and hemp.

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* They are not mentioned by Von Höhnel or Tammes, for instance.

Note.—The pores of flax and cotton are visible when the fibres are mounted in water; of the reagents examined caustic soda of 30°Tw. was found to show up the pores most clearly.

SUMMARY.

(1) Flax and cotton fibres show a great similarity in structure despite the fact that they are not homologous; it is probable that the properties of cellulose play a large part in determining the architecture of vegetable fibres.

(2) Closely similar " dislocation marks " occur in flax and cotton. The nature of the " stomata " of de Mosenthal and " slow spirals " of Balls is elucidated by a comparison of flax and cotton fibres.

(3) Both flax and cotton fibres have minute pores in the cell-wall.

EXPLANATION OF PLATES.

PLATE I.

Fig. 1.—Bleached cotton fibre, mounted in water (x 600). Two rows of " stomata " are seen at the left of the figure. Oblique fissures (*f*), which indicate the trend of the fibrils, and dislocation marks (*v*) are also visible.

Fig. 2.—Bleached cotton fibre, mounted in water (x 600). Here pores (*p*) are visible, as well as rows of " stomata."

Fig. 3.—Bleached cotton fibre, mounted in water (x 600). Dislocation marks (*v*) are present, but " stomata ' are not developed.

Fig. 4.—Flax fibre, mounted in water (x 600). The lamellation of the cell-wall is seen (in optical section). The effect of dislocation marks on the course of the lamellæ is shown.

Fig. 5.—Flax fibre, mounted in water (x 600). Several pores are visible (*p*).

Fig. 6.—Flax fibre, mounted in water (x 600). Dislocation marks are present, and associated with them are rows of " stomata." These latter appear to be enlarged portions of fissures between the fibrils.

Fig. 7.—A diagrammatic representation of a portion of a cotton fibre to illustrate the nature of the " stomata." The trend of the fibrils is indicated by oblique fissures. These are particularly prominent at the dislocation marks, and give the appearance of rows of " stomata."

Fig. 7a.—Portion of a cotton hair in the region of a twist-reversal, slightly diagrammatic. Towards the left of the figure the fibre has a left-handed twist and towards the right a right-handed twist. The course of the fibrils is indicated by the fissures which are present; those on the upper surface of the fibre are made more prominent in the figure.

PLATE II.

Figs. 8 and 9.—Bleached cotton fibre, mounted in caustic soda of 30°Tw. (x 480). Two views of the same fibre are illustrated in order to show clearly the orientation of the pore (*p*) in the fibre. It is to be noted that as far as can be judged the pore extends right to the exterior of fibre, *i.e.*, pierces the cuticle.

Fig. 10.—Flax fibre (x 480), mounted in caustic soda of 30°Tw. Three pores are visible. A bubble (*a*) is present in the lumen; *v* shows the position of a dislocation mark.

Fig. 11.—Flax fibre (x 480), mounted in caustic soda of 30°Tw. Several pores (*p*) are visible.

Fig. 12.—Extremity of a flax fibre (x 1000), mounted in caustic soda. Three pores are visible.

Fig. 13.—Cotton fibre (x 1000), mounted in caustic soda of 30°Tw. Several pores are present. The course of the fibrils is faintly seen.

Fig. 14.—Flax fibre (x 480), mounted in water and compressed beneath the cover-slip. Two pores are shown; the diameter of these has been increased as a result of the compression. The walls of the pores appear to be well-defined structures and to be comparatively rigid.

Fig. 15.—Portion of a raw flax fibre (x 1000), mounted in caustic soda of 30°Tw. The lamellation of the cell-wall is seen. The outer layers have contracted more than the inner layers under the influence of the soda, giving the cut end of the fibre a characteristic appearance. The contorted protoplasmic contents of the lumen are visible. The contraction of the fibre has resulted in the rupture of the outer layers in the position of a dislocation mark. Two pores are visible. Adhering fragments of the middle lamella are present.

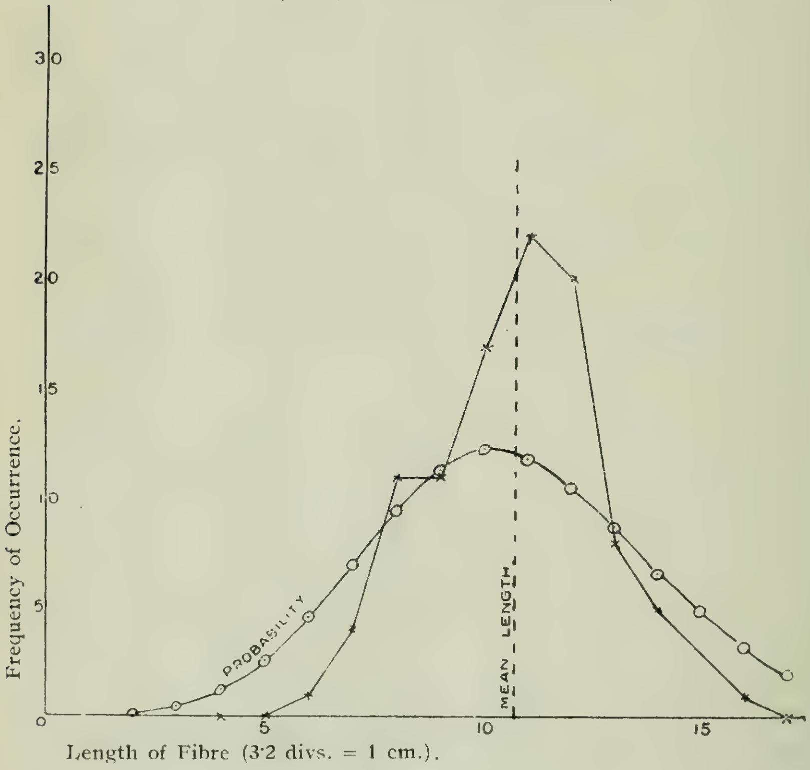
SOME PHYSICAL MEASUREMENTS ON COTTON FIBRES, AND THEIR GRAPHICAL REPRESENTATION.

(By Thos. Barratt, D.Sc., F.Inst.P.)

Measurements have been made of the length, diameter, breaking stress, and extension at break of single cotton fibres from two separate kinds of Egyptian cotton, distinguished below as Á and B respectively. In order to obtain good average results 400 fibres were selected " at random " from each sample of about half a pound of sliver, and 100 of these employed in the examination of each of the four properties mentioned.

A_1. Fibre Lengths.

(Mean = 3·35 cms. = 10·73 divs.)



The method employed for the measurement of " breaking stress " and of " extension at break " is that given in a paper by the present author published in this Journal a few months ago (pp.17-24, Jan., 1922).

The lengths and diameters of the fibres were measured by Messrs. F. H. Parker, B.Sc., and J. W. Lewis, B.Sc., the method employed being to project on a white screen an image of the fibre with known magnification, and to measure the length or diameter on the screen. The magnifications employed were 16·2 diameters for fibre lengths and 880 for diameters.

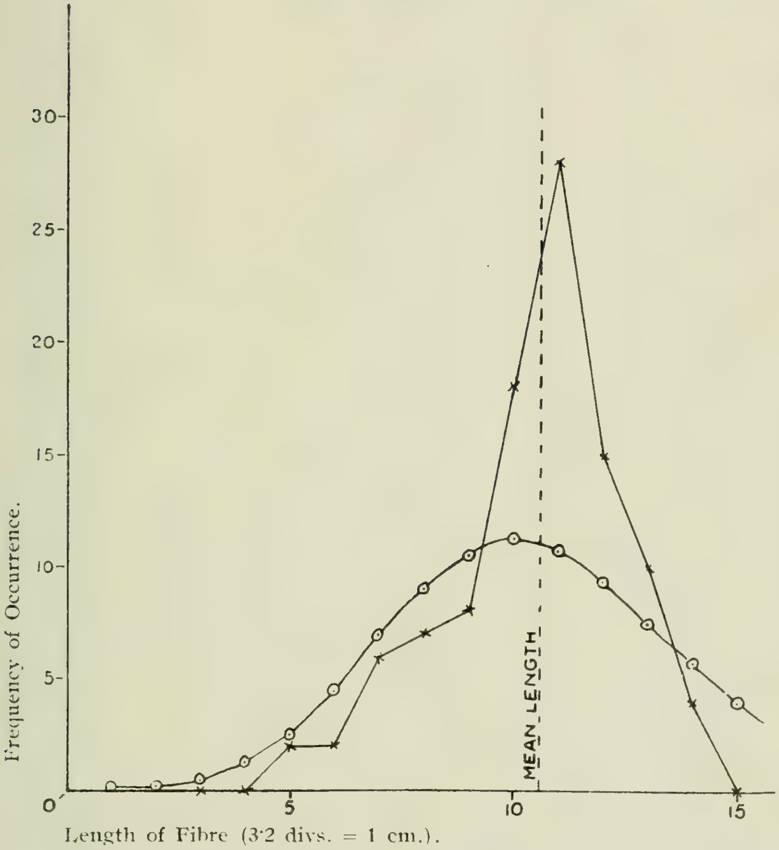
The mean results obtained are given in Table I.

TABLE I.

Sample.	1. Length of Staple.	2. Diameter of Fibre.	3. Breaking Stress.	4. Percentage Extension at Break.
A.	3·35 cms.	0·0167 mm.	5·81 gms.	8·1%
B.	3.28 cms.	0·0151 mm.	4·86 gms.	7·5%

B_1. FIBRE LENGTHS.

(Mean = 3·28 cms. = 10·51 divs.)

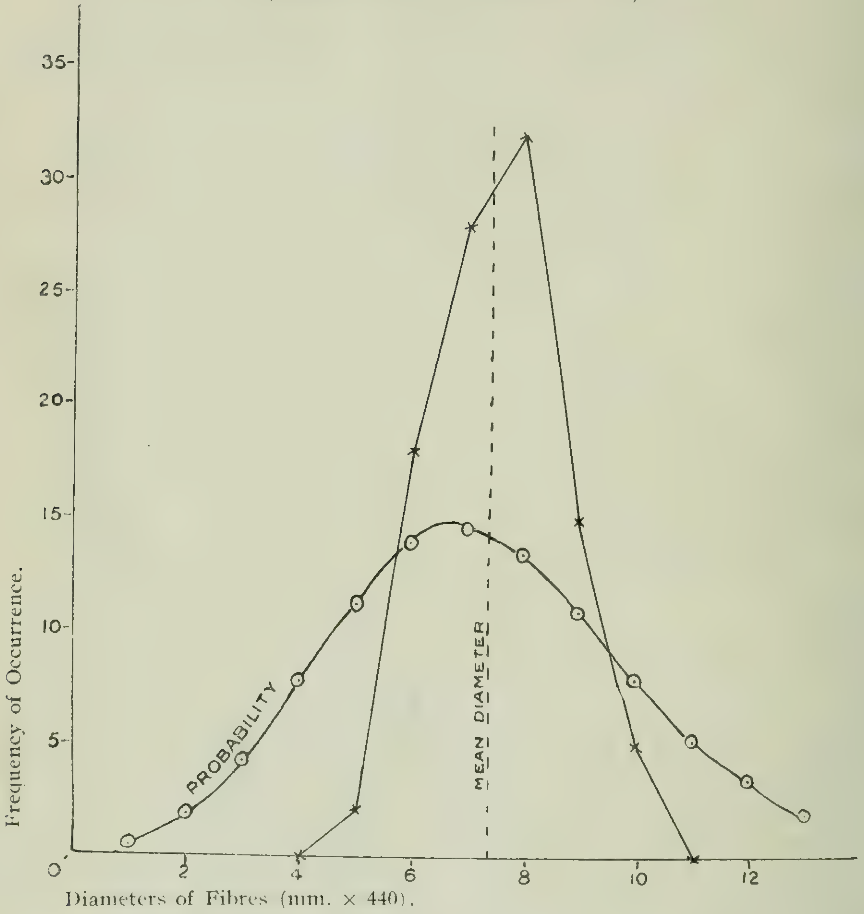


The figures given in this table, beyond showing that the results for A are slightly higher than those for B, give no certain indication as to the relative values of the two samples for spinning and weaving purposes. Much more valuable information is obtained by a close examination of the "Curves" which have been constructed from the individual measurements, and which are given herewith.

The principal object of the present short paper is to show the advantages of comparing the actual curves obtained from experimental results with a "Probability Curve." The latter curve shows what the experimental results might be expected to be if they followed the law of probability for results having the same average value as those given by experiment. The curve is constructed from a formula due to Bateman (Phil. Mag. XX., p.698, Oct., 1910, Note by H. Bateman), which shows that the probability of frequency of occurrence n times is $x^n/n!.e^{-x}$, where x is the average value of all the determinations, e is the base of natural logarithms, $=2{\cdot}71828$ – – –, and n can have all integral values in turn from 1 to infinity.

A₂. Diameters of Fibres.

(Mean Diameter = 7·35 mm. ÷ 440.)



The method of constructing the experimental curve is as follows :—

The results are collected together which lie between 0·50 and 1·49, 1·50 and 2·49, 2·50 and 3·49, etc., etc. Those between 0·50 and 1·49 are reckoned as 1; between 1·50 and 2·49 as 2, and so on. For example, in curve B_4 the results given in the second column of Table II. were obtained for the "elongations of fibres" just before breaking.

B_2. Diameters of Fibres.

(Mean = 6·66 mm. ÷ 440.)

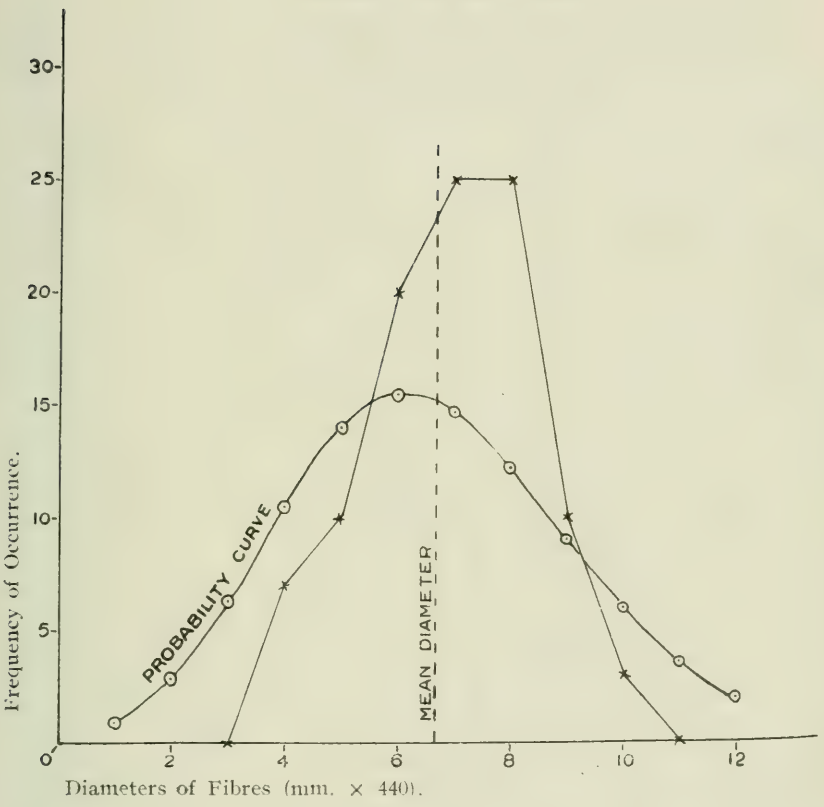
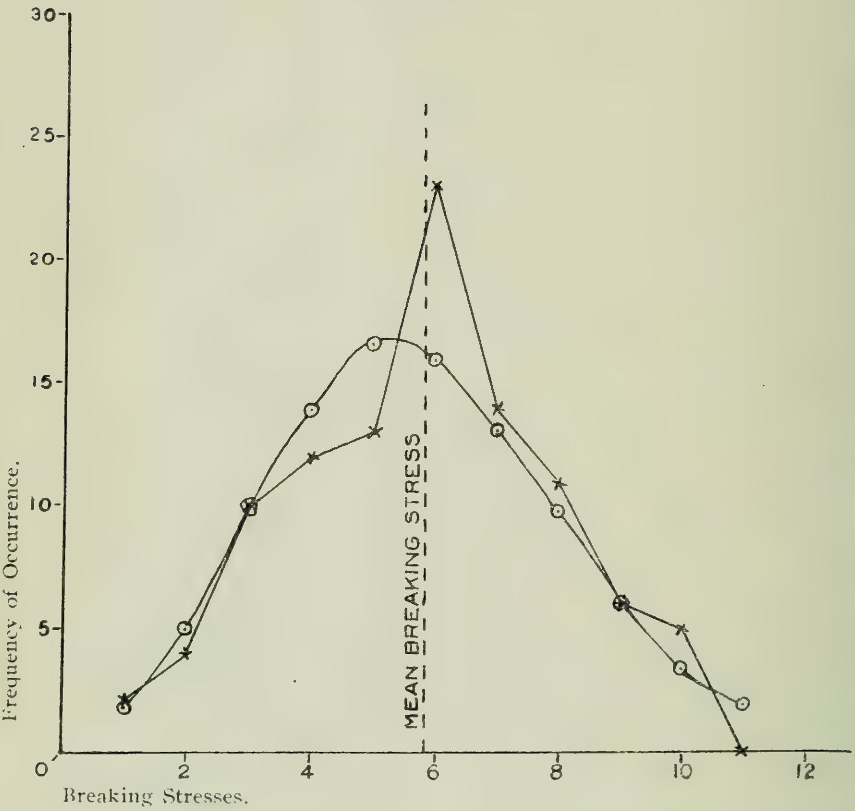


Table II.

Results lying between			Actual frequency of occurrence.	Probable frequency from Bateman's formula.
0·00	and	0·49	0	—
0·50	,,	1·49	8	11·5
1·50	,,	2·49	19	19·4
2·50	,,	3·49	26	21·9
3·50	,,	4·49	23	18·5
4·50	,,	5·49	19	12·5
5·50	,,	6·49	3	7·0
6·50	,,	7·49	2	3·4
7·50	,,	8·49	0	1·4

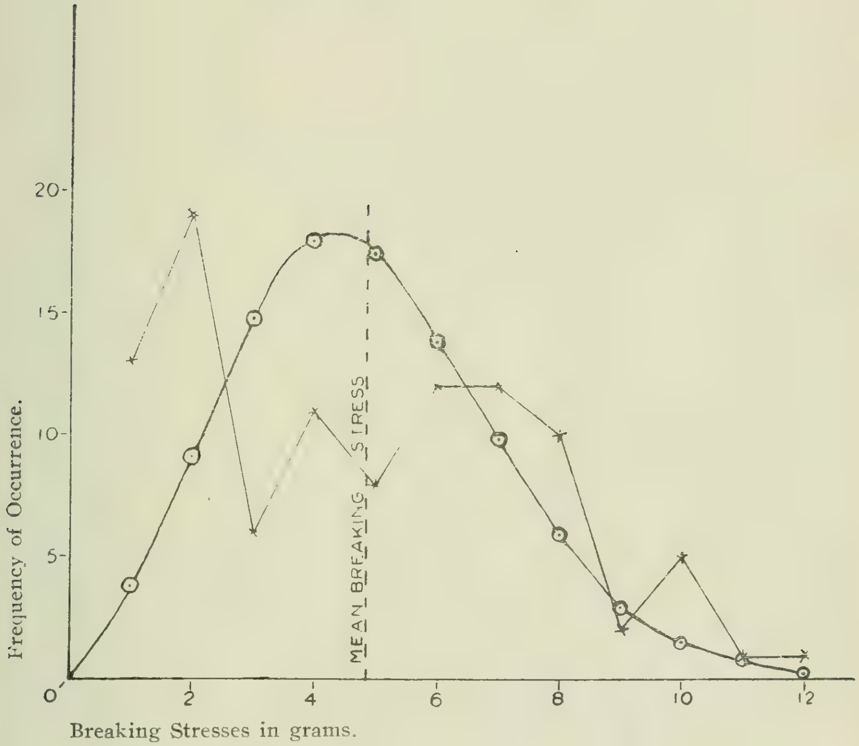
A$_3$. Breaking Stresses of Fibres.

(Mean = 5·81 grams.)



B$_3$. BREAKING STRESSES OF FIBRES.

(Mean = 4·86 grams.)



The "Probability Curve" in B_4 was constructed as below from the formula

$$\frac{x^n}{n!}.e^{-x}, \quad \text{where} \quad x=3{\cdot}381\ ; \quad e=2{\cdot}71828, \quad \therefore\ e^{-x}=0{\cdot}03401.$$

Probable frequency in 100 examples of

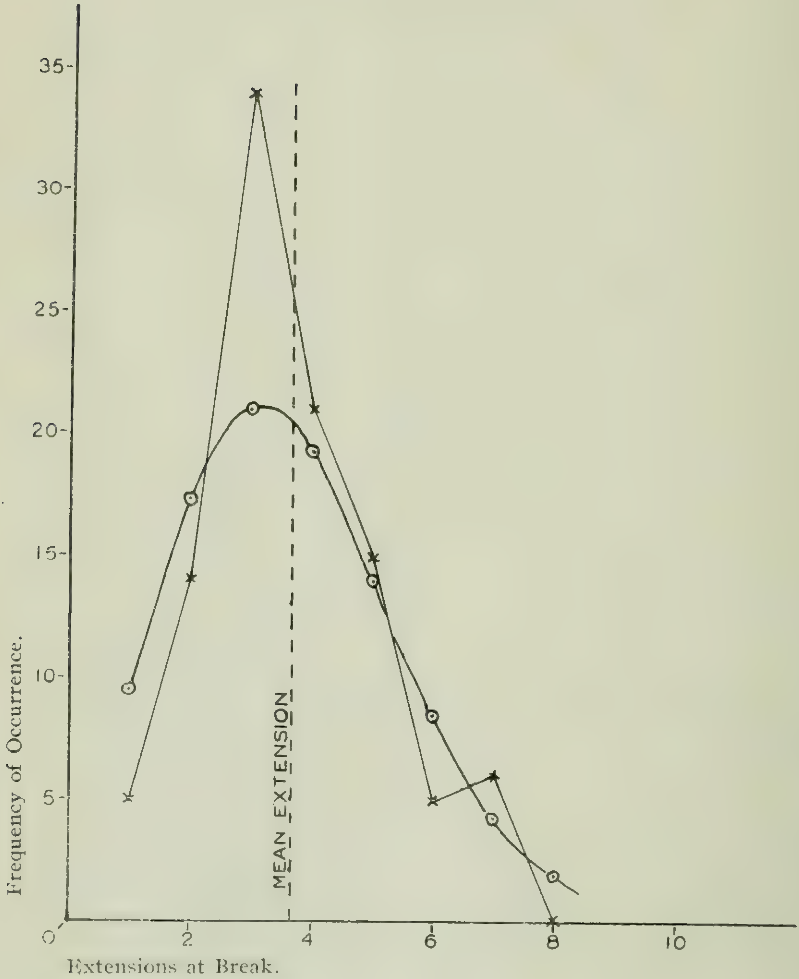
An "extension" of 1 is $\left(\frac{(3{\cdot}381)^1}{1\,!}\times 0.03401\right)\times 100=11.5.$

An "extension" of 2 is $\left(\frac{(3{\cdot}381)^2}{2\,!}\times 0.03401\right)\times 100=19.4$

etc., etc., etc.

A_4. Extension of Fibres (of length 13·5 mm.).

(Mean Extension = 3·64 × 0·3 mm.)



In all the curves the actual experimental results are marked by crosses (x), and the corresponding probable values by circles (⊙).

The representation of these experimental results in the form of curves, and their comparison with the " Probability Curve," brings out very clearly certain important points which might easily be overlooked from consideration of the numerical figures alone. A tall, narrow curve such as A_2 or A_4 is, of course, the sign of uniformity in the property examined. Comparison of the experimental curve with the corresponding probability curve enables one to say with certainty whether the uniformity exhibited is better or worse than what we may call the average. Take, for example, the " breaking stresses " of the fibres as illustrated by the curves in figures A_3 and B_3. It is quite clear that in this property at least sample A is very decidedly more uniform than B, and it is to be expected therefore that a fabric made from the fibres of A would be superior in wearing qualities to one made from B.

B_4. Extensions of Fibres (of length 13·5 mm.).

(Mean Extension = 3·38 × 0·3 mm.)

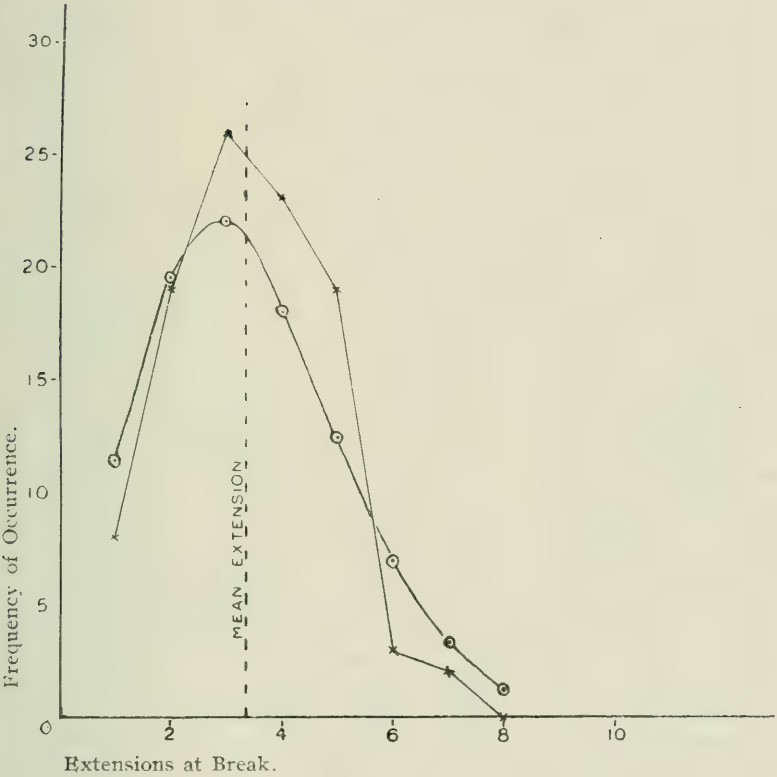


Figure B_3 also emphasises another point worthy of consideration. The experimental curve has more than one peak. This may denote either

(1) a mixture of two or more different types of fibre (E. A. Fisher, "The interpretation of quantitative experimental results in textile research," Journ. Text. Inst., July, 1921); (2) want of care in the choice of fibres to be tested; or (3) an insufficient number of examples.

From a consideration of all the curves given, it is clear that sample A is superior to B, and this was fully borne out by further investigation.

(Received for publication 23/8/22.)

MERCERISATION OF SINGLE COTTON HAIRS.

By R. S. Willows, M.A., D.Sc., T. Barratt, D.Sc., & F. H. Parker, B.Sc.

Though Mercer discovered, in the middle of the last century, that strong caustic soda solutions produce a marked change in the physical and chemical properties of cotton, very little is yet known about the mechanism of the action. On the chemical side, experiments have been adduced which are supposed to show that a soda-cellulose compound is formed, but such evidence has not gained general acceptance.

On the other hand, the physical changes produced, such as those on length, section and volume, production of lustre, etc., have usually been measured on yarns and fabrics, where the conditions are very complicated, so that the quantity to be measured depends on several factors the effects of which cannot be separated. For example, Hübner and Pope (J.S.C.I., p.404, 1904) have measured very carefully the changes in length of yarn when placed in sodium hydroxide solutions of different concentrations, and have so compared "degree of mercerisation" produced. The change in length here is the resultant of changes in both length and section of the hairs and of slipping or other accommodation of the hairs in the yarn. Hence, if a similar set of experiments were made on yarn of different count or twist, it is probable that different results would be obtained, and in either case no information would be given concerning the effect on one single property of the hair. If such information were gained, it might prove to be one step towards understanding the technical process of mercerisation and might also throw light on the structure of the cotton hair.

A series of experiments has therefore been carried out on the changes in length of cotton hairs produced by sodium hydroxide under different conditions. At the same time, the change produced when the soda is washed out has also been followed—a point which has been rather neglected in earlier work. The measurements have been carried out at different times and by different methods by the two last-mentioned of the present authors. The apparatus used was mainly the balance already described by Dr. Barratt (Jl. Text. Inst. (Trans.), p.17, 1922) where the load is applied by an electrical device and the change of length is magnified about 200-fold.

The material used was combed Egyptian sliver, which was boiled for one hour in a 2% solution of sodium carbonate. Hairs taken from this were separately mounted in paper clips and were then placed in the special clips of the balance. A constant load of 50 mgms. was imposed to keep the hair taut; the average breaking load being six to seven grams, the hair can be regarded as nearly free from tension. With suitable illumination, a magnified image of the hair could be projected on a screen by means of a 6in. photographic lens; knowing the magnification, a measurement of this image gave the length. The hair was immersed in the liquid the effect of which was being tested and the change of length was measured by the magnifying device described in the earlier paper.

TIME REQUIRED FOR THE COMPLETION OF THE ACTION.

In piece mercerisation the fabric is exposed to the action of soda for periods which vary with the machine used. Times varying between 20 secs. and 1½ mins. appear to be common. During this exposure the lye is required to penetrate the yarns and also the separate hairs. It is usually stated in books that the action of the lye is over in a few seconds; this is not true, even for hairs. Fig. 1 gives the percentage change in length plotted against time for different concentrations of sodium hydroxide, and

Table I gives the contraction at the end of $\frac{1}{2}$ min., expressed as a percentage of the total contraction taken as complete at the end of 3 mins., after which period, in most cases, the change is slow. About 12 hairs were tested to give one point on the curves.

FIG. 1.

Changes in length with time of fibres (scoured) in NaOH solutions under tension 50 mgms. (Temp. 15°C.)

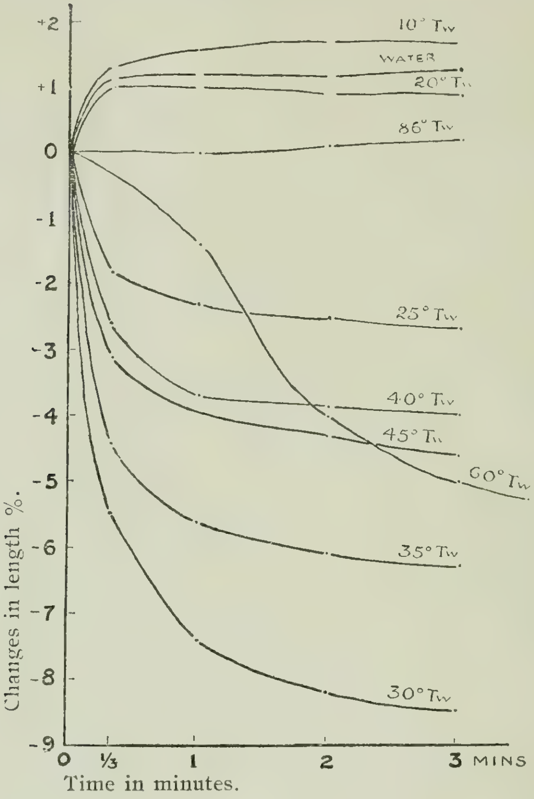


TABLE I.

Twaddell.	Percentage contraction at end of ½ min.
25	·74
30	·73
35	·78
40	·75
45	·72
60	·10

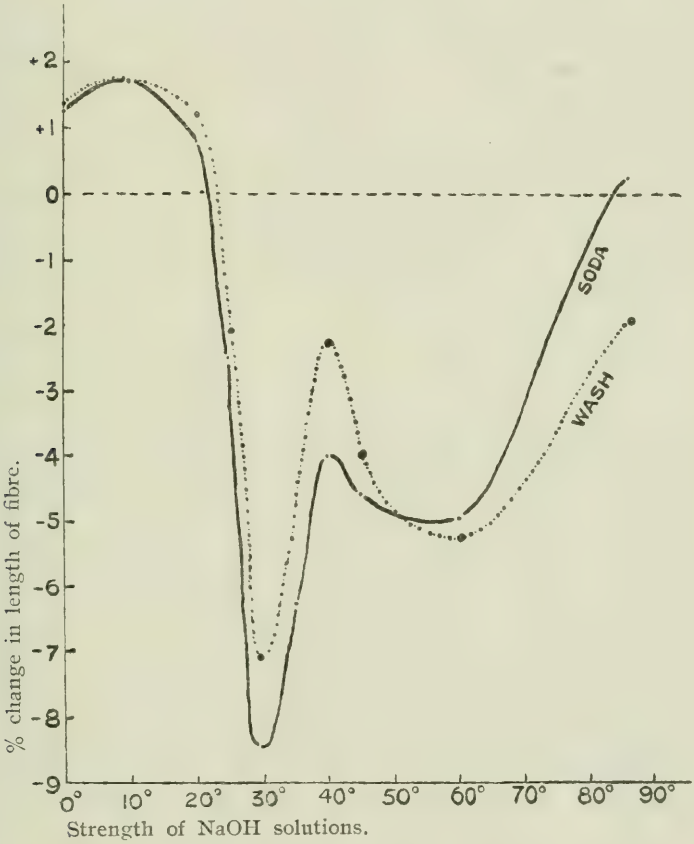
The curves bring out the following features of interest:—(1) The rapid penetration into the hair and the great contraction produced by sodium hydroxide of 30° and 35° Twaddell. (2) The change in the action between 20° and 25° Tw. The contraction begins at 22° Tw. (3) The slow penetration of the 60° Tw. solution. Remembering how difficult it is to wet out a yarn with this lye, it is clear that technical mercerisation of cloth with such a solution cannot be anything like complete in the times usually allowed, unless further action takes place during washing. (4) The very small effect of the strongest solutions, *e.g.*, that at 86° Tw.

TOTAL EFFECT AT DIFFERENT CONCENTRATIONS.

For all except the strongest lyes, the change in length is nearly complete in 3 mins.; this was therefore taken as the time in which the action of all the solutions is completed, and the total change of length was measured for a large number of hairs, all under a tension of 50 mgms. For each point on the curve fifty to two hundred observations were made and their mean taken. At the end of 3 mins. each hair was well washed in cold water and the new length observed. The changes in length produced are expressed on the curves as percentages of the original lengths of the dry hairs. The results are given in fig. 2; the full curve gives the changes produced by the lye alone, the dotted curve the changes arising from mercerisation followed by washing.

Fig. 2.

Changes in length of Cotton Fibres (scoured) placed in NaOH solutions. Tension 50 mgms. (One fibre in one solution.)



The difference of ordinates of the two curves, therefore, gives the change by washing alone. There was an interval of several months between the measurements from which figs. 1 and 2 were drawn, and owing to variation of temperature they are not strictly comparable, yet there is close agreement.

The relation between change in length and concentration proves to be unexpectedly complicated, and we believe has not previously been worked out so fully. Features of interest to which attention may be directed are:—

(1) Fibres have their maximum length when in lye of 10° Tw. The change of length is probably due to the gradual softening of the fibres and the straightening out of the convolutions, as a similar extension, but less in amount, occurs in water.

(2) The big change beginning shortly after 20° Tw. That mercerisation rapidly sets in about 22° Tw. has been independently noticed by other workers in this laboratory. Thus Miss Wigley has noted that, when the scoured sliver is immersed in a lye of 20° Tw., the colour is scarcely changed and the cotton appears as bright as it does in water. When lye of 23° Tw. is used, the cotton becomes darker, duller, and slimy. Also, hairs treated on the microscope stage with 20° and 25° Tw. solutions differ in that with the former few of the convolutions are removed but with the latter most of them disappear, although the fibre outline is still irregular.

(3) The marked contraction at 30° Tw. Structural changes have been noticed here, but they will best be dealt with in a later paper.

(4) Of solutions between 25° and 68° Tw., that at 40° Tw. brings about the minimum contraction. Hence, if it be required to print NaOH on a fabric so as to produce a greater affinity for dyes, but little shrinkage, 40° Tw. should be used.

(5) The change in length produced by washing. When a solution of any strength up to 52° Tw. is washed out of cotton hairs, they extend in length; for stronger solutions, there is a contraction additional to that produced by the lye. If contraction be a measure of mercerisation, we may say that when such strong solutions are washed out additional mercerisation is produced, and this effect is greater all the stronger the original solution. Thus 86° Tw. produces practically no effect, but after washing there is a contraction of 2%.

Working with yarns, Hübner and Pope found a contraction in length for every strength of solution.

EFFECTS OF TEMPERATURE AND TENSION.

To make the curves more complete, the experiments should be repeated with different tensions and at other temperatures. These effects have not been investigated very completely. As far as tension is concerned, an increase tends to smooth out the maxima and minima, and finally causes an extension in every solution. Smaller tensions of about 5 mgms. have also been used. The contractions are then greater, but whether this is the only variation from the results shown in fig. 2 is not known, as these observations were made in the early stages of the work and time was not found to return to them. As to temperature, this part of the work is not finished, so we may limit ourselves to the statements that a decrease of temperature causes a greater contraction above 22° Tw. and the maximum effect is produced with weaker solutions. For example, at 0°C. the maximum contraction is produced by a 25° Tw. solution. Similar results are well known in yarn mercerisation. It is hoped to give more complete observations later.

EFFECTS PRODUCED BY WASHING OUT THE LYE.

It has been shown that strong solutions have little action, but that some mercerisation takes place during washing. This is probably due to the lye being diluted until it reaches concentrations where its action is more vigorous. If this be true, it is evident that the rate of washing will have an influence, since the mercerising action takes time to develop; for if in a few seconds the concentration be reduced from, say, 80° Tw. to 20° Tw., the intermediate strengths will not have time to act. If goods are mercerised with 90° Tw. soda, we should therefore expect the result to be better when washing is done by sprinklers than it is when the cloth is suddenly treated with a large volume of water. This question of washing seemed to be worthy of examination in more detail. The results given are the average of measurements on about 20 hairs. A hair was fixed on the balance under a tension of 50 mgms. and was exposed in succession to the action of sodium hydroxide solutions of decreasing concentrations. Finally, the soda was washed out with cold water. The changes were made by bringing up a beaker containing the liquids so as to immerse the hair. This method insured that each hair was washed in the same manner.

Fig. 3.

Changes in length of different fibres under tension 50 mgms. when put in NaOH solutions, strong to weak. Temp. 15°C.

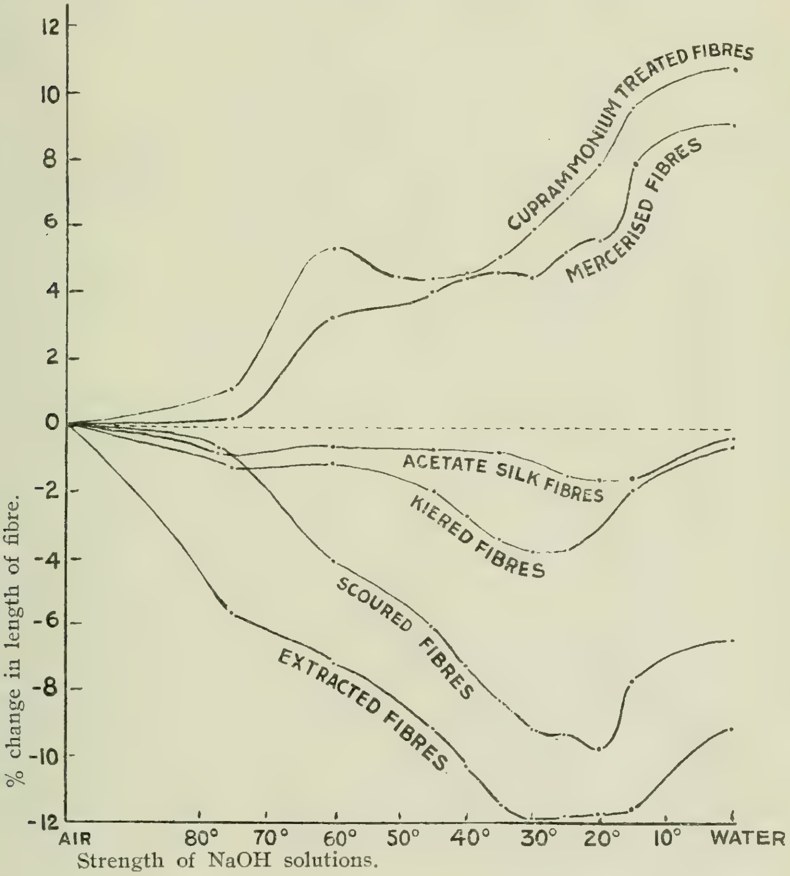


Fig. 3 ("scoured") shows the result when the strongest solution was about 77° Tw.; it indicates what might be expected to happen to hairs passed through a solution of strength 77° Tw. and then washed slowly. The large amount of mercerisation produced during washing is clearly brought out, the maximum not being reached until the concentration is reduced to

20° Tw. If it be remembered that a decrease of length is accompanied by an increase in diameter of the hair, the washing effects shown in fig. 3 are supported by some observations on diameter changes. These experiments were carried out by Miss Drury. Some hairs were placed between microscope slides, were mercerised with 60° Tw. soda, and their images projected on a screen. Diameters were carefully measured at specified points, after which the hairs were washed five times with a weaker solution, and new diameters taken. This was repeated with still weaker solutions, the final liquid being water. These washings caused an increase in the diameter of the hairs, which reached its maximum near 15° Tw.; it then kept nearly constant until the concentration was 5° Tw., or rather higher, after which it decreased rapidly. The increase in diameter caused by washing amounted to 40%. An increase in diameter or a decrease in length of the hairs will tend to cause shrinkage of the yarn containing them; hence, the conclusion can be drawn that if cloth passing off the mercerising frame after immersion in 60° Tw. lye has not been washed sufficiently to reduce the strength of the liquor in the cotton to less than 15° Tw., a shrinkage in the cloth will tend to take place in the washing beck.

Fig. 4.

Changes in length of different fibres under tension of 50 mgms. when put in NaOH solutions, weak to strong. Temp. 15°C.

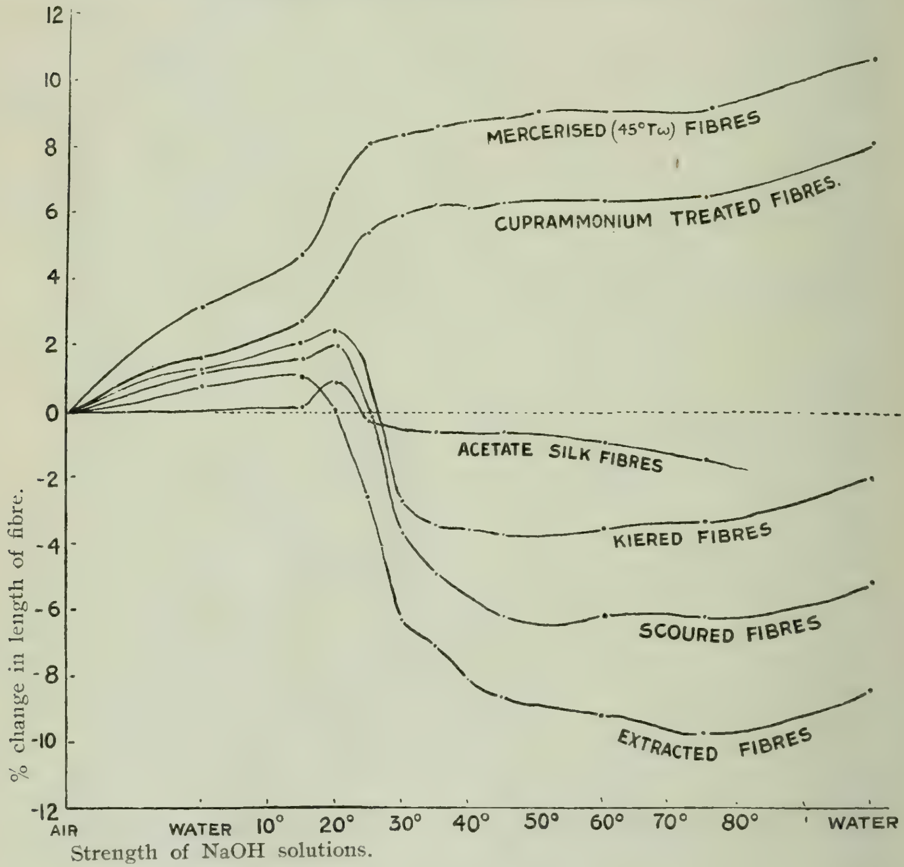


Fig. 4 ("scoured") shows the result of transferring a hair to successive solutions of increasing strengths. It will be noted that mercerisation again sets in just above 20° Tw., but the run of the curve after 30° Tw. is altogether different from that depicted in fig. 2. The maxima and minima at 30°, 40°, and 55° Tw. do not now appear; the fullest mercerisation is reached at about 45° Tw. and is unchanged when the hair is placed in stronger solutions. The combined effect of all the solutions is also less than that of a single solution of 30° Tw.—6·3% in fig. 4 as compared with 8·5% contraction in fig. 2. Too much weight must not be placed on these values as not more than ten hairs were put through this cycle.

EXTENSIBILITY OF HAIRS.

It is well known that it requires much less force to prevent a yarn from contracting during mercerisation than it requires to pull it out again to its original length if it is allowed to contract freely. This is found to be true for single hairs also. For example, as the mean of a number of experiments, it was found that 0·16 gm. was required to maintain the original length when hairs were placed in 35° Tw. soda, while other hairs, allowed to contract, required 0·32 gm. to pull them out to their initial lengths.

DISCUSSION OF RESULTS.

In seeking an explanation of the results shown graphically in fig. 2, several possibilities present themselves. There may be corresponding changes in the solutions themselves; they may be due to structural peculiarities of cotton hairs, and would then not be shown by other vegetable fibres; or, finally, they may signalise a series of chemical reactions with cellulose. To explore all these possibilities would require a range of knowledge we do not possess. It is, in fact, partly with the hope of securing the co-operation of the botanist and chemist and saving useless repetition of work that this paper is published.

As far as we can find from published results and special measurements made of specific properties in the laboratory, the solutions show no peculiarities capable of explaining the observations. This applies to density, viscosity, surface tension, refraction, electric conductivity, and specific heat, though the last has not been very carefully measured.

As to structural peculiarities, it was thought that the maximum effect of the lyes might occur at different concentrations for the cuticle and the main body of the cellulose and that this might provide a possible explanation. To test this, fibres were used which either did not possess a cuticle or in which the cuticle had been modified. As has already been stated, the cotton used in our main experiments was scoured; we now added hairs which had been kiered for two hours under pressure, others that had been extracted with benzene and ether, or had been mercerised with 45° Tw. soda, and, finally, some that had been treated with cuprammonium solution until the cuticle had been ruptured. Figs. 3 and 4 show the results obtained when a single fibre was placed in succession in solutions of decreasing and increasing strengths respectively. Taking first the three lower curves, the results are quite parallel though they differ in amount. The extra contraction of the extracted fibres is most probably due to better penetration of the soda. To explain the decreased contraction of kiered fibres is more difficult, since here also the penetration should be good. It may be due to the general weakening of the fibre and especially of the cuticle through the kiering. This would cause the fibre to be more extensible under the load imposed. Taking next the two upper curves; the cotton here had been hydrated, and this has altogether altered the action.

Evidently, the cuticle has little effect, otherwise these two curves should differ widely from each other, for in one set of fibres the cuticle has been destroyed while in the other it is still present though possibly changed. More information could perhaps be obtained by repeating the experiments with no load on the hairs, and also under the conditions in which fig. 2 was obtained, but, unfortunately, the experiments had to be discontinued at this stage without much hope of resumption.

We hope that the observations we have recorded may encourage others to take up the theory of mercerisation from the chemical side. On the question of chemical versus physical change we have open minds, but an observation made by one of our colleagues, Mr. J. W. Lewis, appears to point in a chemical direction. Some strong cuprammonium solution was diluted until, as observed with the microscope, it swelled hairs to about the same extent as 40° or 45° Tw. soda *but did not dissolve them*. Hairs were placed on a slide on the microscope stage and cuprammonium solution was run on, after which 45° Tw. soda was added, but this produced no change. Next, the solutions were mixed before application to the hairs, and the swelling was rather less than before. The cuprammonium solution was also unable to dissolve hairs that had been mercerised and dried. If, however, the caustic soda was run on unmercerised hairs, the surplus drained off, and the cuprammonium then added, solution of the cotton took place at once. The simplest explanation of these facts seems to be the formation of a soda-cellulose compound which is readily soluble in the cuprammonium, since, roughly, the same extent of surface is exposed to its action in all cases.

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CHANGE IN SECTION OF COTTON HAIRS ON MERCERISING.

By R. S. Willows, M.A., D.Sc., and Miss A. C. Alexander, B.Sc.

In a paper already issued from this laboratory, the results have been published of some measurements of the change of length of cotton hairs when they are mercerised (see preceding paper in this issue). For certain purposes, it would be useful to know the over-all change of volume at the same time. Owing to the irregular shape of the hair, this cannot be deduced from measurements of the diameter in any plane. In the present paper, there is given a description of an attempt to measure the change in area of thin sections when they are acted on by caustic soda. This method seemed likely to give results differing from those obtained by any methods involving immersion in a liquid, whereby the density is found; such methods would depend on the penetration of the liquid if the hairs are porous, but the results, combined with an over-all measurement, would give important information on the sponginess and internal surface of the hair.

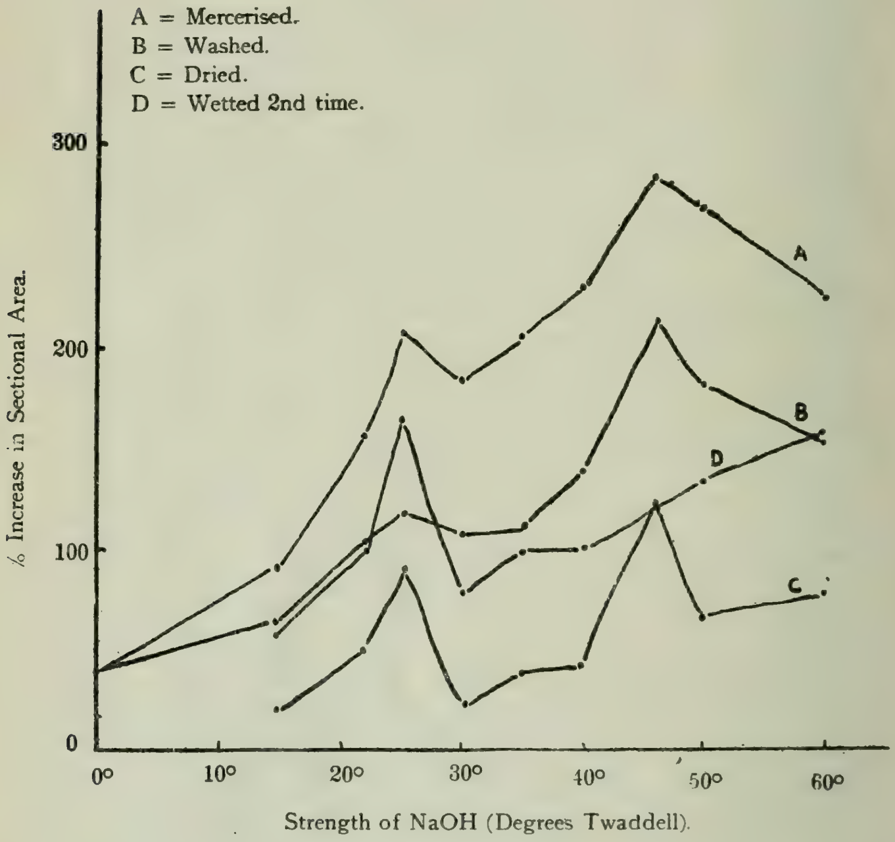
Sections of scoured Egyptian sliver or rovings were cut by the method already described (*Jl.* Text. Inst. **12,** 4, 1921). They were fixed to a glass slip with agar-agar, 14% strength dissolved under pressure at 120°C., and the mountant was dissolved off with acetone. The slip with the section was laid on the microscope stage, illuminated with a Pointolite lamp. The eye-piece of the vertical microscope was replaced by a right-angled glass prism, and an image of the section was projected on a screen at a distance of about three metres, giving a magnification of about 700 diameters.

Sheets of smooth paper, as uniform in weight as we could find, were weighed and pinned on the screen, the image of the section was projected thereon and the outlines of the separate hairs were traced.

This was done when the hairs were (1) dry, (2) wetted with water, (3) mercerised, (4) washed with water, (5) dried, (6) wetted with water a second time, two drawings being made at each stage. After a few experiments, stage (2) was omitted, so that the strength of the caustic soda acting on the hairs should be accurately known. The hairs were numbered in each drawing, the same hair having the same number throughout the experiment. Finally, those tracings which were recognisable at every stage were cut out and stored in a loose condition along with another sheet which had previously been weighed. After a day or two, the cuttings and the loose sheet were weighed; from the variation in the weight of the latter a correction could be made to all weights on account of a change in the humidity of the air. We now had the weight per unit area of the sheets from which the drawings were cut, and the weights of the cuttings calculated back to the same humidity; thus the area of the sections could be determined. All changes in area were expressed as percentage increases on the original dry area. The increase in area on first wetting out with water was found from a number of experiments to be from 40 to 42%. Working in this way, it was found that two drawings of the same set of sections gave results which agreed within about 5% but that the results from different sections varied over 100%. If the area in the soda were taken as the one to which all the others were referred, the irregularities produced by the later treatments were much reduced, even allowing for the greater accuracy with which the large area could be determined. Much time was spent in varying the conditions of the experiments as much as possible, but without improving the agreement. We finally came to the conclusion that the observed irregularities were not experimental errors but were due to the difference in the behaviour of the individual hairs when acted upon by caustic soda. Whether this is due to a difference in the ripeness or development of the hairs, we cannot say. The difficulty could perhaps be partly overcome by using only well developed hairs and cutting the sections from the middle part of each. We felt, however, that the results would then depend too much on our judgment in making the selection; in addition, we wanted to know what the average result would be on the hairs in, say, a well mercerised yarn.

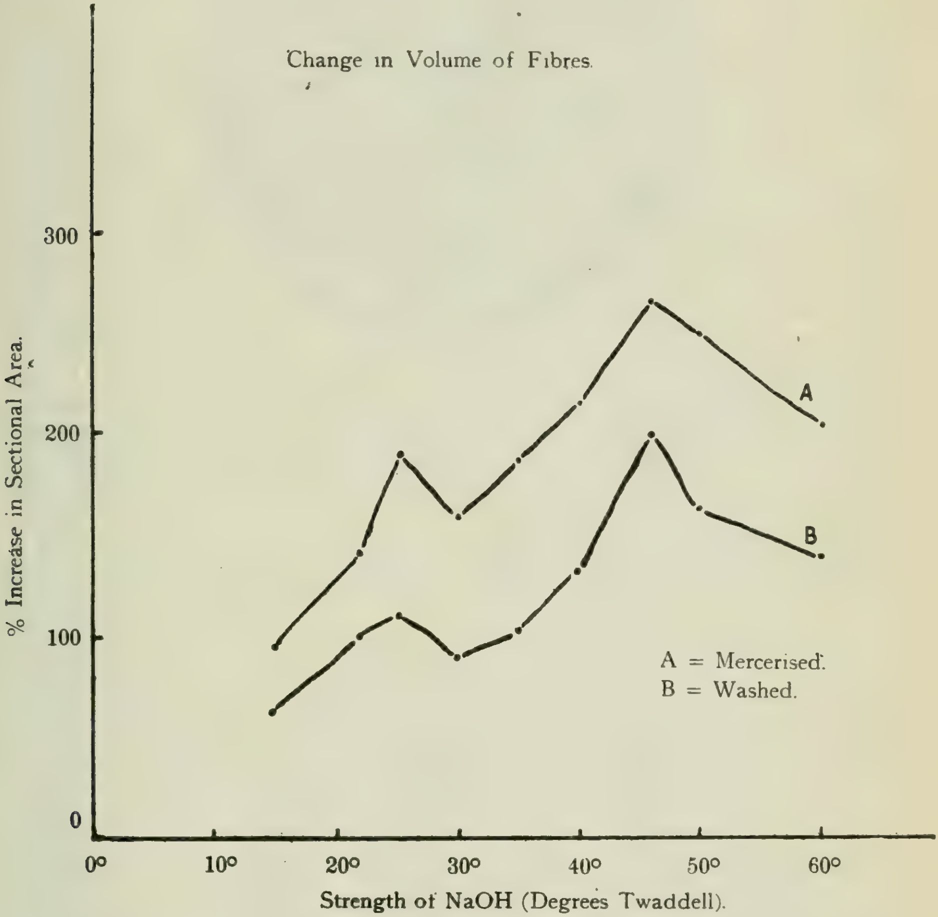
As some hundreds of hairs were used to fix one point on the curve of results, these curves may be taken as giving a rough average result, and as, so far as we know, such numbers have not been published before, we give in the form of curves the measurements for what they are worth. Fig. 1 gives the changes in sectional area, and Fig. 2 the changes in volume.

Change in Sectional Area of Fibres

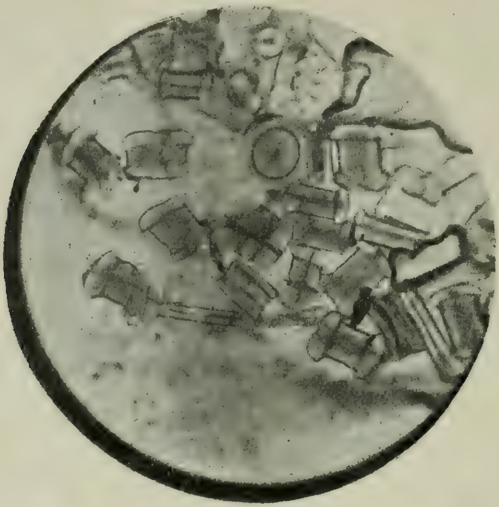


The latter have been obtained by combining the present results with those on the change of length already mentioned. Such a calculation involves, of course, the assumption that whole hairs, when treated with caustic soda, change in area by the same amount as thin sections; this we think is not quite true.

While working with 30°Tw. caustic soda it was noticed that several of the hairs showed a dark central portion, with the canal practically closed and a lighter rim. This appearance is due to the inner part of the hair bulging out at the ends over the cuticle. It could be better seen if the mountant was dissolved off and the section was not stuck to the slide, so that some of the short pieces of fibre turned over on to their sides. These when mercerised presented a dumb-bell appearance. Further experiments showed that this bulging begins with 25°Tw., is very pronounced between 30°Tw. and 40°Tw., but is not very apparent at 45°Tw. or above. It must be recalled that the maximum contraction in length of the hairs takes place in a solution of 30°Tw. At this concentration the tendency of the cellulose to swell is very great, but the cuticle is not sufficiently softened to allow the full volume to be reached; some of the cellulose is therefore extruded. The contraction in length will also aid this.



These mushroom-shaped ends are clear evidence of the strength of the cuticle. The force required to move a substance like cotton cellulose along a narrow bore tube of the diameter of the fibre must be enormous. In the stronger solutions, the cuticle is evidently more extensible, for the diameter of the swollen hair is greater and there is no bulging at the ends. A photograph showing fibres with the ends swollen is given.



We find this effect affords a very simple test for the presence of tendering. In such cases the cuticle is generally damaged, and so allows the inner walls to swell freely when caustic soda is applied. The hairs are then found to swell abnormally in diameter without bulging at the ends.

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PRELIMINARY NOTE ON THE DESTRUCTION OF THE COTTON HAIR BY MICRO-ORGANISMS.

By Humphrey John Denham, M.A., Oxon., F.R.M.S.
(The British Cotton Industry Research Association).

Though it is known that the quality of cotton yarns and fabrics may be seriously impaired by the attack of moulds and bacteria, the precise nature of the damage is perhaps not so well understood. The typical mouldy smell produced by a few types of organism constitutes almost the only practical test for damage unless the latter is sufficiently advanced to produce marked tendering or discolouration, though it is clear that considerable weakening and degradation of the material may take place without arousing any suspicion of its presence.

The following notes and their accompanying figures illustrate the modes of weakening which may occur under such attack. No attempt is made at this stage to name the types of infection shown, since organisms which have produced considerable damage in a given sample at one period of its history may have since then perished entirely, and have been replaced by subsequent infections.

Material.—The material used in this preliminary investigation was derived from the following sources:—

(1) "Country damaged" cotton from a bale chosen at random in a Liverpool warehouse.
(2) Mildewed cloth from various sources, as received and after incubation in a moist atmosphere at room temperatures.
(3) Cotton milldriving rope showing pronounced decay.
(4) Sea Island cotton stained by "plant bugs," *i.e.*, boll piercing insects.
(5) Seed cotton from various sources, especially Indian types.
(6) Bolls of Upland cotton attacked by *Fusarium* spp.

Methods.—Single hairs or minute fragments of suspected cottons were mounted in liquid paraffin B.P., a medium of rather low refractive index (1·47) which has the effect of giving greatly increased contrast owing to the "contour bands" produced by the difference of index between object and mounting fluid: it is also neutral with regard to aniline stains, is non-hygroscopic, and does not distort the cotton hair. The slides were examined under fully critical conditions of illumination with an apochromatic optical system, monochromatic light being supplied by Wratten filters, used with a 30 C.P. Pointolite fitted wiih the control previously described[1]. For the higher magnifications Zeiss homogeneous immersion objectives of N.A. 1·40 were used. Since the thickness of the cotton hair makes the photography of the minuter organisms at the high magnifications necessary (x1500) very confusing (though permitting fairly accurate observation), the larger types of organism have been used wherever possible to illustrate this note. This allows the use of microscope objectives, such as the Zeiss 8mm. of N.A.0·65, which have sufficient depth of focus at the comparatively low magnification of x200 to give an accurate representation of the relation of the organism to the hair attacked.

Observations.—From the examination of a very large number of hairs in all stages of infection and degradation, it would appear that the cotton hair is liable to attack at several points, which, arranged in order of vulnerability, are as follows:—

(1) Broken ends of the hair, and deep cracks reaching the lumen.
(2) Abrasions, shallow cracks, and "pits."
(3) The normal surface of the hair or cuticle.

In the material investigated, central canal infection is by far the most common, probably on account of the nitrogenous matter present. It would seem that invasion by a large number of diverse forms of a saprophytic nature is the rule, rather than the exception, in material which has been allowed to become damp at any stage in its history. The second and third groups involve organisms living in the wall layers or on the surface of the hair, which are possibly more purely cellulose destroying types, finding their food supply in the complex of substances which compose the wall, but differentiated by their ability or failure to penetrate the waxy protective surface of the cuticle. In the absence of precise knowledge of the condition of the cuticle, and of the existence of pores and other weak spots in its surface, it is often difficult in practice to distinguish the two forms of attack.

It should be remembered that all three types of growth merge into each other and may overlap; thus, an organism which begins its growth in the central canal from the broken end of a hair may attack the wall layers when it is once established, and may eventually rupture the wall and grow outwards to attack other hairs (Figs. 1, 2). Again, an organism may attack both the central canal and wall layers simultaneously, as in text-fig. C,

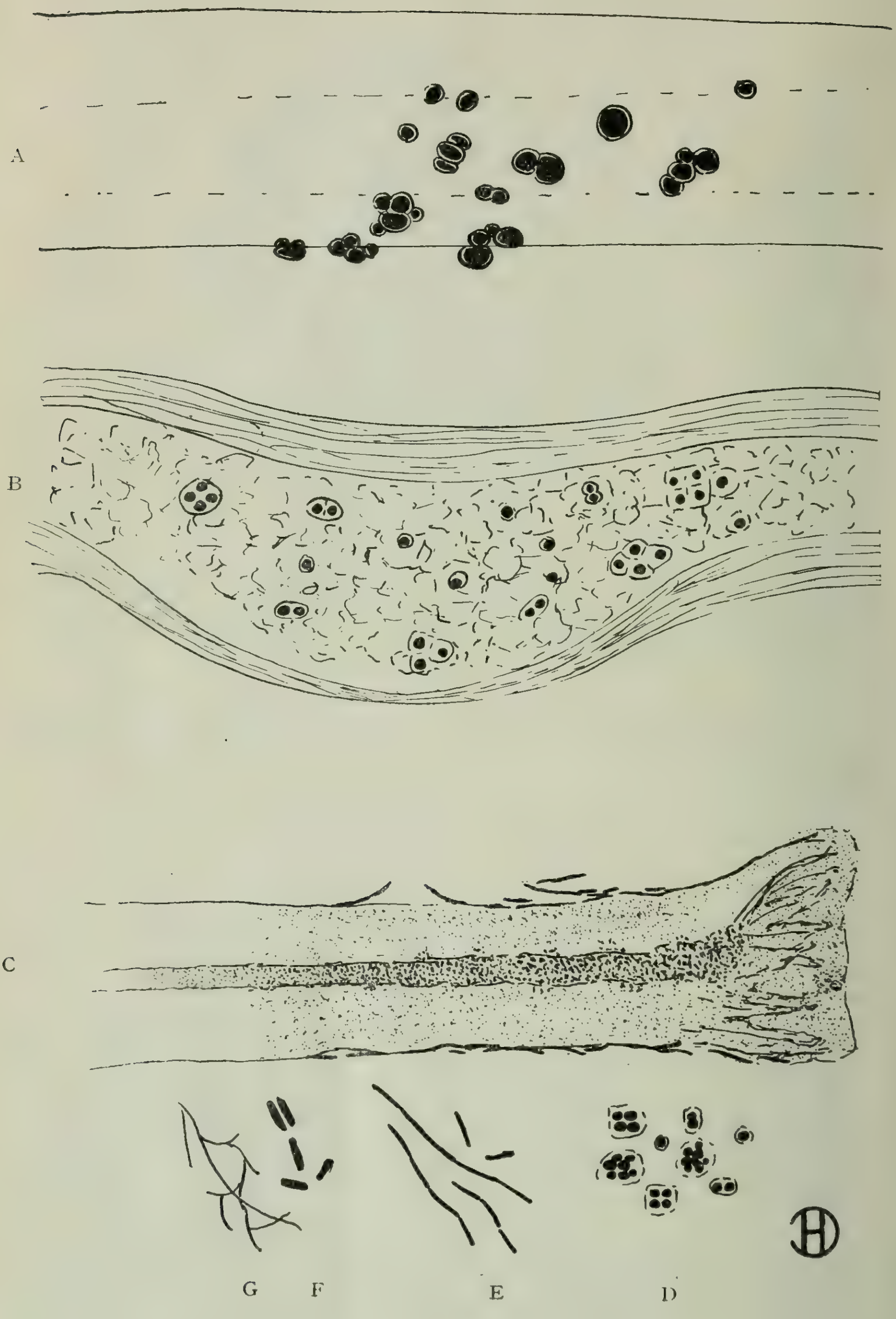
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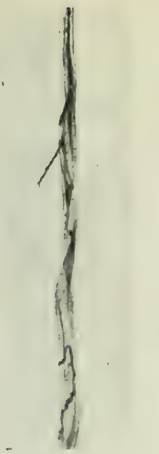
PLATE I.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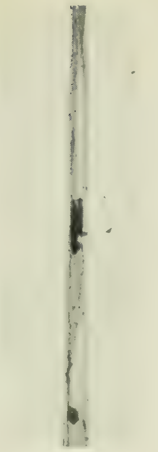
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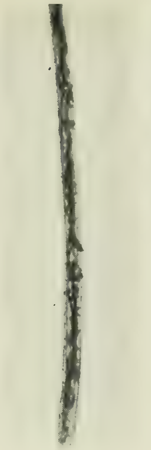
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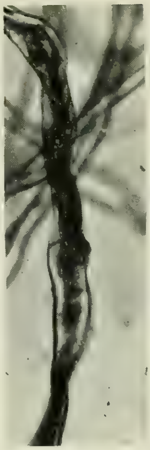
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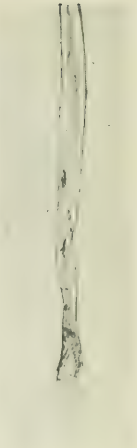
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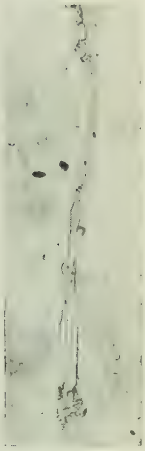
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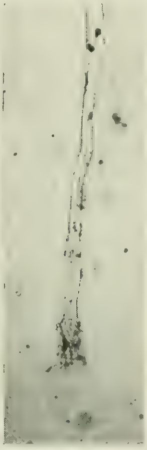
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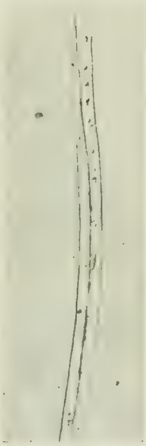
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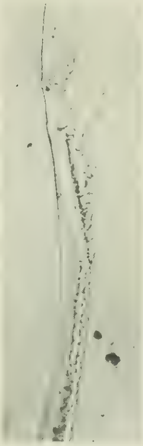
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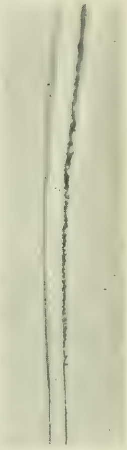
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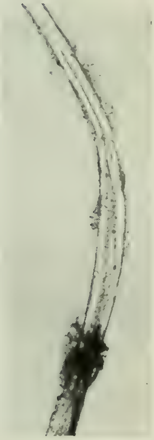
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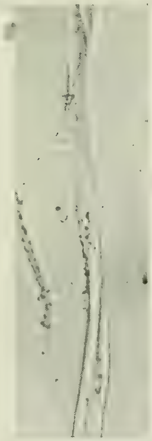
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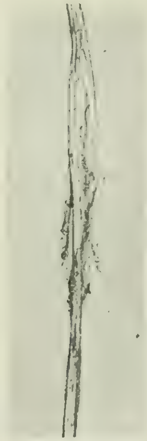
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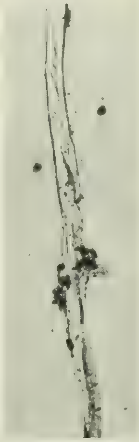
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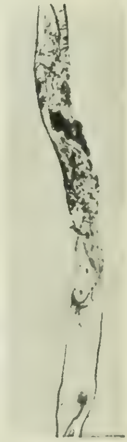
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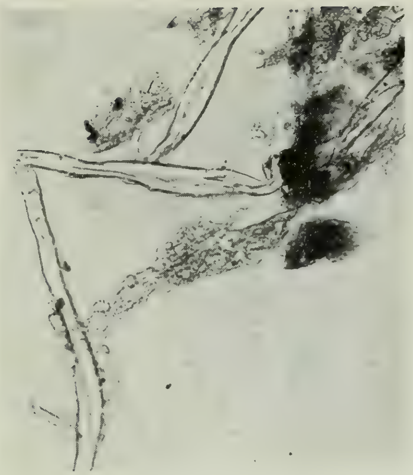

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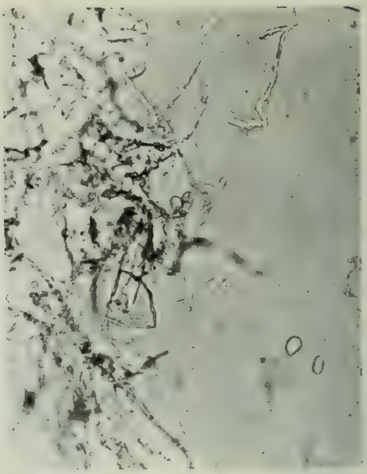

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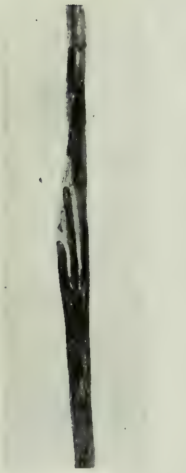

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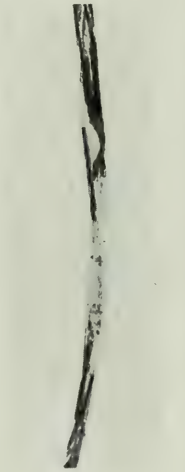

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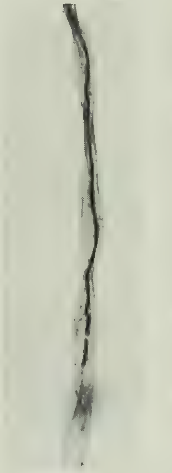

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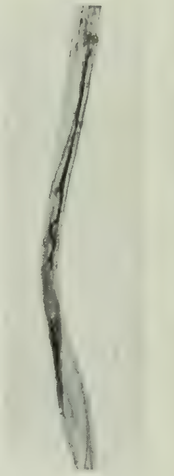

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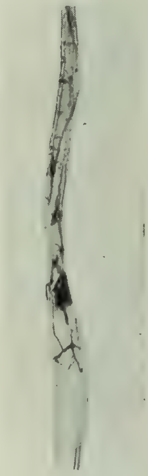

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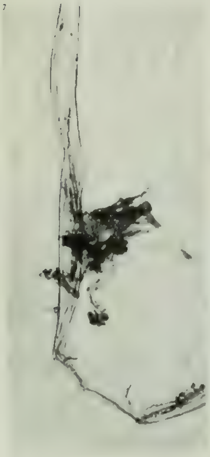

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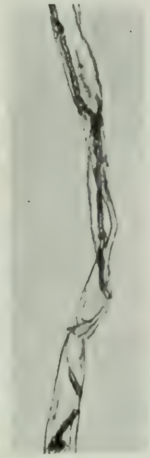

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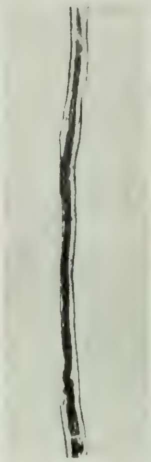

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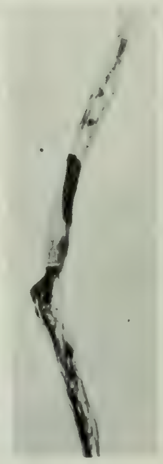

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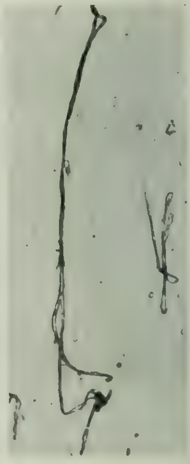

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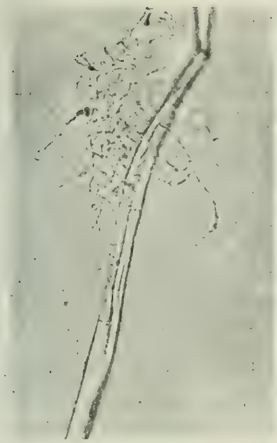
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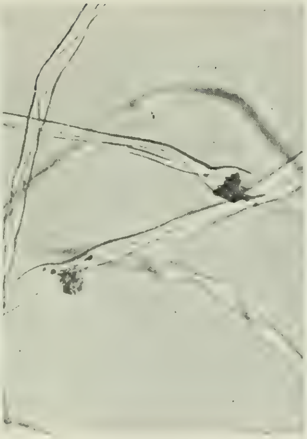
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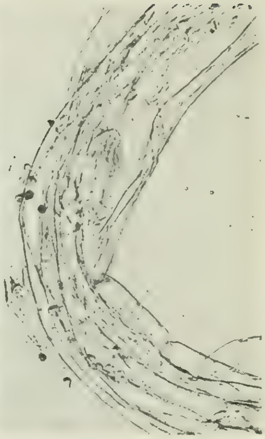
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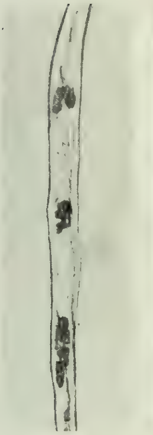
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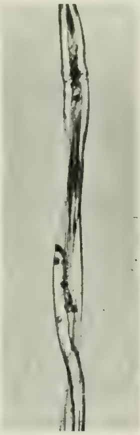
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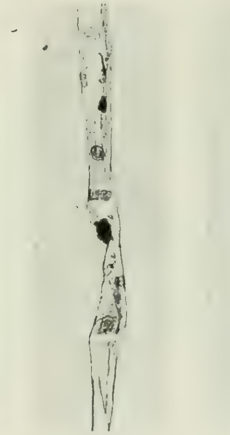
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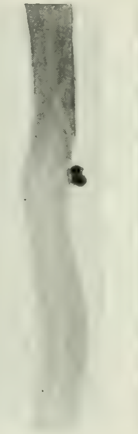
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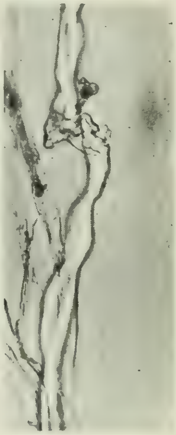
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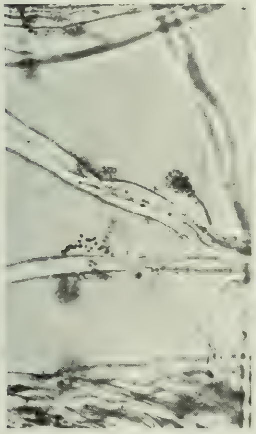
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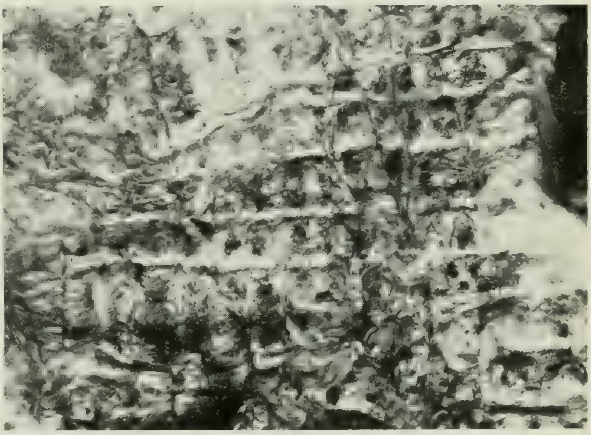
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DESCRIPTION OF PLATES.

TEXT FIGURE.

A. Toruloid organisms in pure culture growing on surface of hair taken from decaying rope. From a pencil sketch.

B. Coccoid organisms in interior of hair after treatment by swelling reagent (sodium hydroxide—carbon disulphide). From a pencil sketch.

C. Terminal infection of hair, showing frayed end with mucilaginous magma, sloughing of cuticle and relative penetration of organisms in wall and lumen. Semi-diagrammatic. (July, 1919.)

D. Sarcina form with mucilaginous envelope, from the hair shown in C.

E. F. G. Bacterial and streptothrix forms from decaying boll of Upland cotton.

PLATE I.

1, 2, 3. Streptothrix forms growing in lumen of cotton hair (Bharat Kapas) and piercing the wall. In Nos. 1 and 2 the wall has been pierced and the organism is emerging. In No. 2 the lumen has been blocked by a plug of the organism, and the hair shows signs of attack by minuter forms in the immediate neighbourhood of the plug. No. 3 is a later stage, possibly another organism, though a form similar to No. 1 occurs further down the hair (not shown).

4. Rupture of the wall by the pressure of an internal growth. (From country damaged cotton).

5. Terminal infection, showing " dry " degradation. Decayed cloth.

6, 7. Terminal infection, showing " wet " degradation, with mucilaginous magma. Decayed cloth.

8. Breakdown in the wall layers (stained naphthamine-blue and cotton-red). From a seed of Cambodia cotton.

9, 10. Fungal growth ramifying along cuticle. From Bharat Kapas unstained. This organism agrees closely with a species which occurs in West Indian bolls punctured by plant bugs.

11. From mildewed cloth, unstained, bacterial and toruloid forms.

12. From decayed cotton rope, chiefly toruloid organisms.

13. Sloughing of cuticle under attack. (Cotton rope.)

14, 15. " Wet " surface degradation. No. 14 from cotton rope; No. 15 from tendered cloth.

PLATE II.

16, 17, 23. Late stages of degradation by mixed infection, from bolls of Upland cotton. In No. 17 the cotton has been entirely replaced by a mass of mycelium, spores and bacteria, which are visible in the original photograph. No. 16 illustrates the peculiar brittleness of cotton in the latter stages. In No. 23 the greater part of the wall has disappeared, leaving only a thin strand. Both fungal hyphae and bacteria present.

18, 19, 25. Fungal hyphae growing in interior of lumen: Nos. 18 and 19, unseptate hyphae; No. 25, septate. From Bharat Kapas, stained naphthamine-blue and cotton-red.

20, 21, 22. Streptothrix forms, probably of the types shown in the text figure above. Bharat Kapas, stained as above.

24, 26. Hyphae growing on outside of hair. No. 24 from cotton rope, stained ammoniacal Congo-red. No. 26 from country damaged cotton, unstained.

27. Fragment of mycelium from yarn beneath colony of *Rhizopus* sp., on mildewed cloth, unstained.

PLATE III.

28. Mycelium ramifying from surface of hair taken from ripe boll of moulded Upland cotton.

29. Growth on surface of hairs from Trinidad cotton infected by stainer insect punctures.

30. Small nep of cotton from same material, showing toruloid organisms and spores *in situ*.

31, 32. From country stained cotton.

33, 35. From insect stained cotton.

34. From decayed rope.

36. Fungal fructifications between warp and weft of mildewed " Dhootie," with some spores already shed.

37. Surface of bale of " country damaged " American cotton from a Liverpool warehouse, after removal of " bagging "; one-third full size. No less than five different types of saprophytic organisms could be recognised in cotton taken from this sample, in addition to large numbers of bacterial and coccoid forms.

taken from a sketch of a hair infected with a pure culture of a sarcina form from decaying cotton rope. Here the dotted portion represents the limit of penetration of the organism, which can advance more rapidly in the lumen than in the wall layers.

Internal degradation may be relatively inconspicuous, and a hypha or a *Streptothrix* may penetrate a hair from end to end without attracting attention in a microscope preparation, unless coloured spores are produced, or the hair is treated with a stain. Actual damage may take place either from the organism attacking the wall and reducing its effective thickness at one or more points (Fig. 3) or from the bursting of the wall by the pressure produced by internal growth (Fig. 4).

When the infection spreads in the wall layers, a progressive splitting and shredding of the laminæ is the general case and two main types of attack, occurring under different conditions of dampness, can be distinguished from examination of the broken end of the hair. The first of these is a " dry " degradation, in which the broken end shows a typical fibrillar appearance easily differentiated from the normal clean or jagged break of an uninfected hair (Fig. 5), while the second is characterised by an extrusion of a mucilaginous magma at the broken end, consisting of degradation products from the wall layers, together with large numbers of bacterial forms. These organisms can be recognised at a high magnification (x1500), though coarser forms are generally present also, as can be seen in Figs. 6, 7.

Destruction by one form only is not normal in commercial material, but can be produced in pure cultures.

Often it appears that a definite cleavage takes place between two laminæ of the wall, by the penetration of the organism along some obscure line of weakness. In such a case a line of bacterial action can be seen in the thickness of the wall, growth of the organism not proceeding uniformly, being greater in some places than in others (Fig. 8). Cracks in the wall are frequently found filled with a deeply staining mass, which on higher magnification can be resolved with difficulty into bacterial forms: such observation is complicated by the optical errors introduced by the thickness of the hair, and by the impossibility of gauging the depth of a crack in surface view.

Surface growths of bacteria, yeasts and hyphæ are perhaps the most commonly observed because they are relatively most conspicuous There is ample evidence that many irregularities and anomalous structures, which have hitherto defied elucidation, are really saprophytic growths, or the direct result of such growths on the hair; thus, schizophyta in the lumen may sometimes be taken to be granular protoplasmic remains, the " endochrome " of earlier writers on the structure of cotton. Again, a minute unicellular organism may give the appearance of a pore in surface view, or of an extrusion in side view, though in the absence of confirmatory evidence from other parts of the same hair it is manifestly unsafe to define it as either. At high magnifications there is always a difficulty in deciding whether a given spot on the cuticle is really a perforation or not, the slightest movement of the fine adjustment causing a complete change in the image. Thus it is usually impossible to ascertain, except by direct cultural methods, whether any given organism has the power of piercing the cuticle, but from the manner in which certain organisms can spread along the hair (Figs. 9, 12) it is at least probable that actual penetration can take place through the unbroken surface. Whether this is the case or not, it is evident that the damage produced by ginning, scutching and carding, which manifests itself not only in abrasions of the cuticle, but also in cracks and fissures which often reach the lumen, inevitably increases the susceptibility of the cotton to invasion by micro-organisms.

An effect frequently observed is the stripping off of the cuticle by the ramification of a surface growth (Fig. 13) though the seat of the damage may in some cases be obscured by a mucilaginous magma, such as occurs at broken ends (Figs. 11, 14, 15).

There is evidence[2] that some cottons are more resistant than others to attack, and even in the same sample immature hairs are more susceptible than those which are fully developed. In many specimens thin walled hairs could be seen in the last stages of decomposition, while normally thickened hairs alongside remained intact even when swathed in hyphæ.

Fleming and Thaysen[2] have recently claimed that the extent of bacterial damage to cotton can be quantitatively ascertained by the behaviour of the material under a swelling reagent, and even that the nature of the infection can be thus defined. Their method really depends on the behaviour of the cuticle under the stresses produced by the swelling of the wall layers in the reagent and, obviously, slight mechanical damage to the cuticle, such as occurs in ginning, will produce fallacious results, while an organism which does not affect the cuticle, however extensive its ravages in the lumen and the wall layers, may escape observation. The behaviour of a number of swelling reagents has been tested, and critical examination of a large number of infected and normal hairs confirms this view.

The ultimate stages of degradation are rapid, the hair breaking down to an amorphous mass of debris (Fig. 16) which is eventually absorbed and replaced by a tangled mass of hyphæ, mixed up with bacteria, yeasts and spores. (Fig. 17.) The whole mass breaks up on drying into a fine dust which serves to infect fresh material. The intermediate stages of decomposition are of great interest, a marked feature being the extreme brittleness which occurs in partly degraded hairs. Fig. 16 shows the peculiar way in which such hairs break under manipulation.

Discussion.—From the above observations it is apparent that serious damage may exist in cotton before any indication of its presence can be detected by the usual tests, and that one or two points of infection may very seriously interfere with the spinning qualities of a hair. It therefore becomes of importance to guard against the possible development of micro-organisms in all stages of manufacture, particularly in those processes, such as conditioning, which involve the addition of moisture to cotton. Further researches are in progress in this laboratory on the specific modes of degradation by definite organismsm in pure culture, and the whole question of the external relations of the micro-organisms attacking cotton is under investigation.

REFERENCES.

1. Denham; Nature, May 5, 1921, p.369. Microscope illumination and fatigue.
2 Fleming and Thaysen; Biochem. Journ., 1920, **14**, 25; 1921, **15**, 406. Deterioration of cotton in wet storage.

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THE CLINGING POWER OF SINGLE COTTON HAIRS.

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INTRODUCTION

The strength of cotton yarn does not depend entirely upon the tensile strength of the hairs incorporated in it. When soft spun yarn is broken, the majority of the hairs are not fractured, but merely slip one over the other, and although this slip diminishes in more tightly twisted yarns, it must still play some part, even in ostensible " snap " breaks. In actual practice the strength of twist yarns varies between 15% and 75% of the tensile strength of the hairs in the cross section.

It appears, therefore, that the clinging power of the hairs is a physical property of considerable importance. This power is analogous to the coefficient of friction, but the problem is complicated by the existence of the convolutions in the hair and the presence of various waxes (cf. Oxley, Trans. Text. Inst., 1922, **13,** 92). The following experiments were therefore carried out with a view to investigating the physical relationship between the clinging power of several varieties of cotton hairs and the number of convolutions per centimetre.

EXPERIMENTAL METHODS.

It is usually assumed that the effect of twisting together the sliver of parallel hairs in the spinning process is to produce a lateral pressure on each hair, which causes its convolutions to engage with the convolutions of neighbouring hairs. It seems probable, therefore, that by arranging hairs

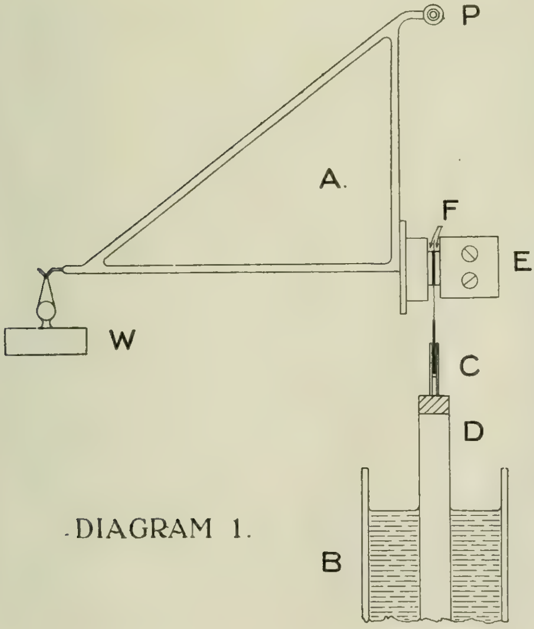


DIAGRAM 1.

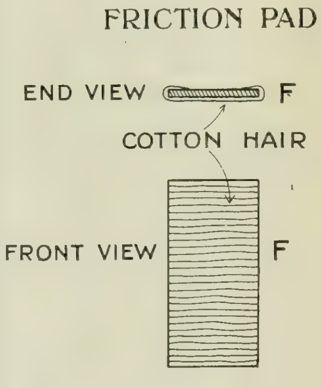


DIAGRAM 2.

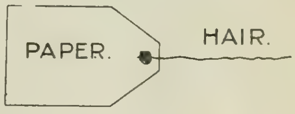


DIAGRAM 3.

in parallel layers and applying a lateral force some of the conditions of spun cotton can be reproduced.

This has been done by coating slips of glass with even layers of combed cotton lint, the hairs being drawn over the front of the glass slip and attached at the back by means of seccotine (Diag. 2). A single hair of known convolutions per centimetre is then placed between these pads, in a direction parallel to the layers of hair, and the pads are pressed together with a constant force which can be adjusted to suit the needs of the experiment. The force necessary to cause the single hair to slip is taken as a measure of the clinging power.

In order to make this measurement, the apparatus is arranged as shown in Diag. 1. The light triangular framework, A, is pivoted at P and carries a weight at W and one of the friction pads at F. The other pad is carried on a block E arranged so that the surfaces of the pads are vertically below P. The force is applied to the single hair by means of O'Neill's apparatus (Mem. Manchester Phil. Soc., 1865), consisting of a wide glass tube, B, containing water, in which floats a narrow weighted tube D. The hair is attached at the top of D, and water is drawn from the wide tube until the hair slips, the mass of water (M) removed being measured. It can be shown that the weight applied to the hair when M grams of water have been removed is

$$\mathrm{M}.\, r^2/(R^2-r^2) \text{ grams.}$$

where R and r are the radii of the outer and inner tubes respectively. The hair is mounted by means of sealing wax, under a tension just sufficient to keep it straight, across a rectangular hole in a slip of paper, which is then stuck lightly to a microscope slide so that the total convolutions across the hole can be counted under a microscope. After counting, the length of the hole in the paper slip is measured and the convolutions per centimetre of the hair are obtained. The slip is then detached from the glass slide and the paper cut away so as to leave the hair fixed to a piece of paper as shown in Diagram 3. This is now attached to the top of the float, one friction pad is lifted and the hair is placed between the pads in such a position that the float is slightly raised. By gently lifting the weight W, the float is allowed to slip down to its normal position, the hair being drawn straight and almost free from tension.

Water is now drawn off through a capillary jet into a measuring cylinder until the hair slips. With cotton hairs this slip occurs suddenly, so that no difficulty is experienced in judging its commencement.

Successive readings obtained with the same hair in this way may differ to a large extent for the following reasons:—

(*a*) The clinging power is a function of the convolutions of the hair itself and of the convolutions of the hairs of the pads against which it lies. In most cottons a large variation of convolutions exists from hair to hair.

(*b*) The pads may not be perfectly parallel and smoothly coated, and consequently the normal pressure may not be constant in all parts of the pad and the force required to cause a hair to slip will depend somewhat upon the position of the hair between the pads. A mean result may be obtained by repeating the observations upon each hair a large number of times. The mean forces given in the appended tables are the average of 15 observations, with the exception of the experiments upon Sennaar Tree Cotton and on TN.2 cotton, where the forces are the means of 100 observations on each hair.

The above procedure is carried through with hairs of various average convolutions per centimetre and the average force required to cause each hair to slip through the pads is plotted against its number of half convolutions per centimetre.

EXPERIMENTAL RESULTS.

The results obtained from the experiments upon five varieties of pure strain cottons have been tabulated and appear below, together with the curves connecting the weight of water withdrawn to cause slipping of the hair, and its *half* convolutions per centimetre. *Half* convolutions are readily distinguished under the microscope.

Sea Island Cotton (AN 2–8–18) between AN 2–8–18 Pads. (Fig. 1).

Half convolutions per centimetre.	Water withdrawn to cause slip (grams). Average of 15 observations.
23	11·1 ± 0·4
26	13·8 ± 0·8
38	18·4 ± 0·9
39	17·0 ± 0·9
43	17·2 ± 0·6
44	19·7 ± 1·1
46	21·2 ± 0·6
47	19·6 ± 0·8
50	20·5 ± 1·1
52	23·2 ± 1·3
53	20·3 ± 1·0
56	23·9 ± 1·1
57	30·0 ± 1·4
59	22·6 ± 0·6
61	25·4 ± 1·2
61	27·7 ± 1·1
65	25·2 ± 0·7
66	24·6 ± 1·1
68	20·2 ± 1·1
68	27·3 ± 1·3
69	20·9 ± 0·9
73	24·5 ± 1·2
73	24·5 ± 1·3
76	20·8 ± 0·9
82	15·2 ± 0·7
83	16·5 ± 0·8
88	15·1 ± 0·8

Sea Island Cotton (V.135) between Sea Island (V.135) Pads. (Fig. 2).

Half convolutions per centimetre.	Water withdrawn to cause slip (grams). Average of 15 observations.
27	17·9 ± 0·5
28	17·2 ± 0·6
32	24·4 ± 0·9
39	25·2 ± 1·4
41	25·6 ± 0·8
46	27·4 ± 0·9
49	27·2 ± 1·1
55	28·4 ± 1·2
56	27·7 ± 1·3
60	33·2 ± 0·9
61	33·9 ± 2·1
67	32·8 ± 1·2
69	26·2 ± 0·9
71	26·7 ± 0·8
74	23·1 ± 1·2
77	23·6 ± 1·0
82	21·1 ± 0·7
83	20·2 ± 0·7
91	16·6 ± 0·8
94	19·9 ± 0·8

Southern Cross Upland Cotton between Southern Cross Upland Pads. (Fig. 3).

Half convolutions per centimetre.	Water withdrawn to cause slip (grams). Average of 15 observations.
22	18·5 ± 0·9
30	19·5 ± 1·0
32	16·7 ± 0·9
38	24·2 ± 0·9
41	19·9 ± 0·9
42	20·4 ± 0·8
45	21·3 ± 0·8
54	29·5 ± 1·0
59	27·0 ± 0·8
59	35·2 ± 0·6
63	32·0 ± 1·4
63	33·2 ± 0·5
68	29·4 ± 1·2
72	31·0 ± 1·2
72	31·4 ± 1·0
79	25·3 ± 0·8
80	26·1 ± 0·8
89	20·0 ± 0·9
94	19·9 ± 0·7

Sennaar Tree Cotton between Sennaar Tree Pads. (Fig. 4).

Half convolutions per centimetre.	Water withdrawn to cause slip (grams). Average of 100 observations.
18	14·8 ± 0·3
22	17·5 ± 0·4
30	20·4 ± 0·4
37	21·8 ± 0·4
46	24·0 ± 0·4
50	24·8 ± 0·3
52	25·5 ± 0·7
60	26·7 ± 0·4
62	29·1 ± 0·4
62	29·2 ± 0·3
66	30·8 ± 0·7
66	28·5 ± 0·4

Trinidad Native—2 Cotton between Trinidad Native—2 Pads. (Fig. 5)

Half convolutions per centimetre.	Water withdrawn to cause slip (grams). Average of 100 observations.
4	26·1 ± 0·7
27	30·9 ± 0·8
37	34·8 ± 0·5
46	34·5 ± 1·2
58	36·1 ± 0·6
62	36·8 ± 0·6
68	37·7 ± 1·3
75	37·7 ± 0·5
82	36·4 ± 1·0
94	34·2 ± 0·6
102	31·3 ± 0·5

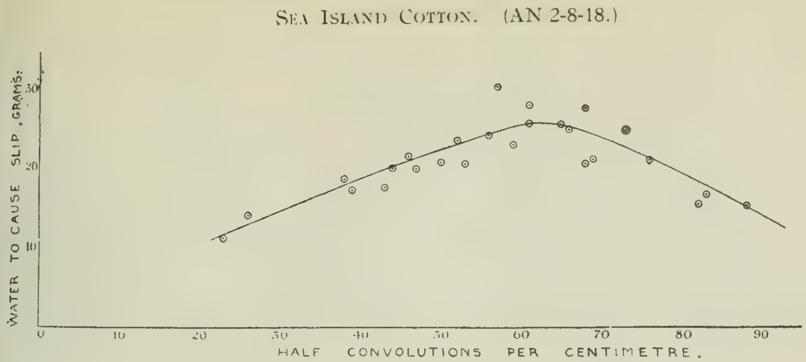

SEA ISLAND COTTON. (AN 2-8-18.)

FIG. 1.

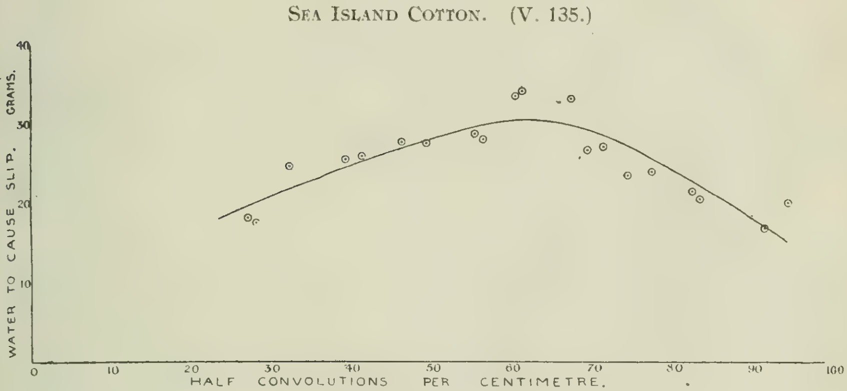

SEA ISLAND COTTON. (V. 135.)

FIG. 2.

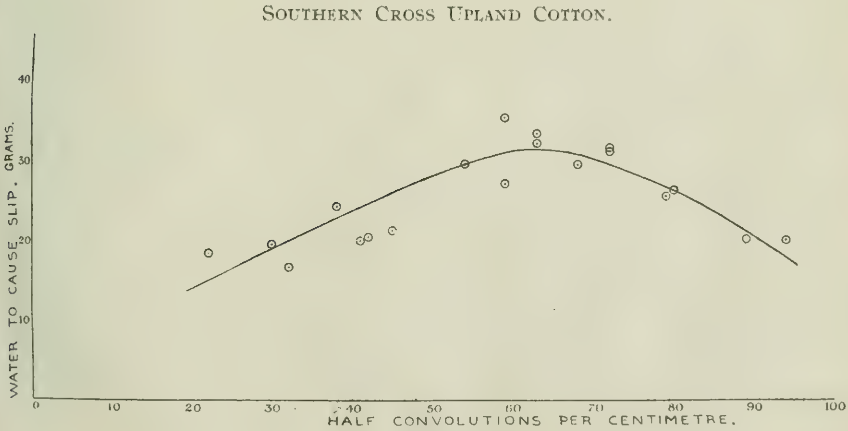
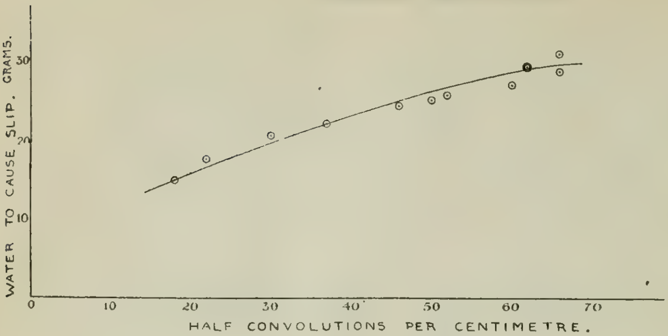
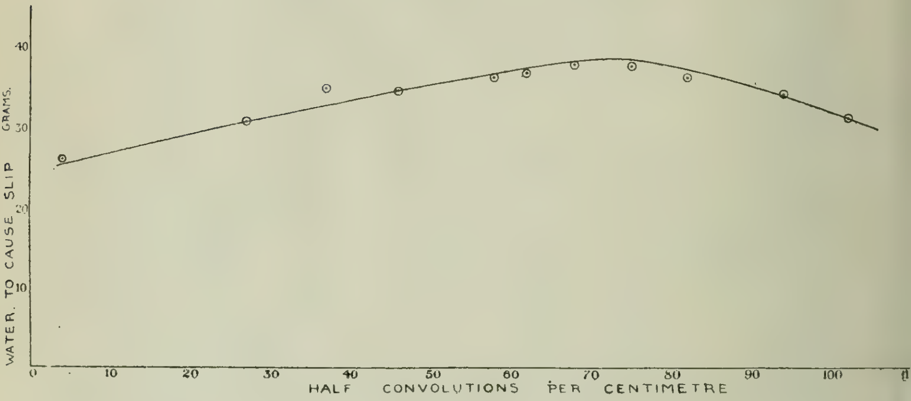

SOUTHERN CROSS UPLAND COTTON.

FIG. 3.



SENNAAR TREE COTTON.

FIG. 4.



TRINIDAD NATIVE COTTON. (TN. 2.)

FIG. 5

Each curve exhibits a well defined maximum, with the exception of that derived from the observations upon Sennaar Tree Cotton, in which variety no hairs were found having greater average half convolutions than 66 per centimetre. These maxima indicate that hairs with a certain average number of convolutions per centimetre require a greater force to cause them to slip between the pads than hairs with either more or fewer convolutions per centimetre. Furthermore, the position of the maxima agree closely with the average half convolutions per centimetre of the variety of cotton used, with the exception of Sennaar Tree Cotton, which tends to a maximum at 70 half convolutions per centimetre, the average number of half convolutions being 40 per centimetre.

With the exception of this cotton, the results indicate that the best clinging power is obtained when the hair which is pulled has the same average convolutions as the hairs of the pads. The clinging power is due to the interlocking of the convolutions. When the hair placed between the pads has the same convolutions as the average hair of the pads, the chances are that it will lie against a hair with which its convolutions will engage more or less perfectly. If the hair placed between the pads has not the same average convolutions as the hairs of the pads, the chances that it will lie against a hair with which it engages perfectly will be fewer and the average force necessary to cause it to slip will be less. This result emphasises the extreme importance of regularity of convolutions from hair to hair, for if all the hairs are convoluted alike, the convolutions of one hair will always engage exactly with those of its neighbours.

This explanation, however, assumes that the convolutions are regular—*i.e.*, that in a hair with 100 convolutions per centimetre the convolutions are all practically 0·01cm. apart. If a hair has 50 convolutions in 0·5cm. and the remainder of the hair is unconvoluted then its convolutions average 50 per centimetre, but it will obviously not engage perfectly with a regularly convoluted hair of 50 convolutions per cm.—but will fit more perfectly with a hair which has 100 convolutions per cm. regularly distributed. The case of Sennaar Tree Cotton can be explained in this way. This cotton appears to have about 40 half convolutions per centimetre on the average, but actual measurement of each half convolution shows that its value is between 0·01 and 0·015cm., the average being increased to 0·025cm. by the presence of unconvoluted lengths of hair. The curve therefore tends to a maximum at about 70 half convolutions per centimetre.

SUMMARY.

The foregoing investigation indicates that the clinging power of cotton hairs depends upon the convolutions, and presumably this power is a factor of importance in the spinning value of the cotton and the strength of the yarn spun from it, especially in soft twisted yarns.

This clinging power is a maximum when the convolutions of as many hairs as possible fit together perfectly. Perfect fitting may be obtained in two ways:—

(1) If the hairs have an equal number of convolutions evenly spaced along equal lengths.

(2) If hairs have varying total numbers of convolutions arranged in groups separated by unconvoluted spaces, the maximum clinging power is attained when the convolutions are identical in the different groups.

The variability of any variety of cotton ensures that this maximum clinging power is never realised in spinning and the strength of a yarn will therefore be less than the ideal conditions (1) and (2) imply.

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A COMPARISON OF YARN SPUN ON THE CASABLANCAS SYSTEM WITH ORDINARY RING YARN.

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I.

In connection with the research work on the general drafting problem, which is being conducted in these laboratories, it was considered desirable to make a detailed comparison of yarn spun on the Casablancas System with that spun on the ordinary low draft ring system. Six bobbins were obtained from each of six frames spinning with the two systems, 72 bobbins in all, the following information being supplied by the mill at which the yarn was spun:—

(1) Raw material for both yarns:—$1\frac{1}{8}''$ to $1\frac{3}{16}''$ G.M. Memphis.
(2) Yarn in both cases:—36's twist.
(3) Speed of spindles in each case:—9,000 R.P.M.
(4) Revolutions of front roller in each system:—104 per minute

In the preparation of the above yarns, the essential difference between the drafting in the Casablancas system and that in the ordinary ring method of spinning was that the Casablancas system performed in the final operation drafting work equal to that which the ordinary system performed in two operations at the roving and ring frames. In the Casablancas system, the yarn was spun directly from the product of the intermediate frame and the roving frame was not necessary.

The actual drafts were as follows:—

	Hank Nos. and Counts.	Ordinary draft.	Casablancas draft.
Hank draw frame	0·13	—	—
Hank slubber	0·70	5·4	5·4
Hank intermediate	1·85	2·6	2·6
Hank rover	5·00	2·7	—
Ring frame	36·0	7·2	19·5

In Fig. 1, scale drawings are given showing the actual arrangements of the systems producing the yarns which were compared. The draft in the Casablancas system between the front rollers and the leather bands was 19·5 and the settings were as indicated in the upper part of the figure. The object of the smallest rollers above and below the leather bands in the Casablancas system is to ensure sufficient pressure to hold the fibres as they are drafted. In the ordinary system of drafting, the final draft was 7·2 and the setting of the rollers was as illustrated in the lower part of Fig. 1. It is true that a draft as high as 20 may be obtained by a close setting of the rollers of the ordinary system, but yarns produced in this way are not discussed in this paper, the object here being simply to compare the qualities of yarns spun with the Casablancas and ordinary ring systems of drafting.

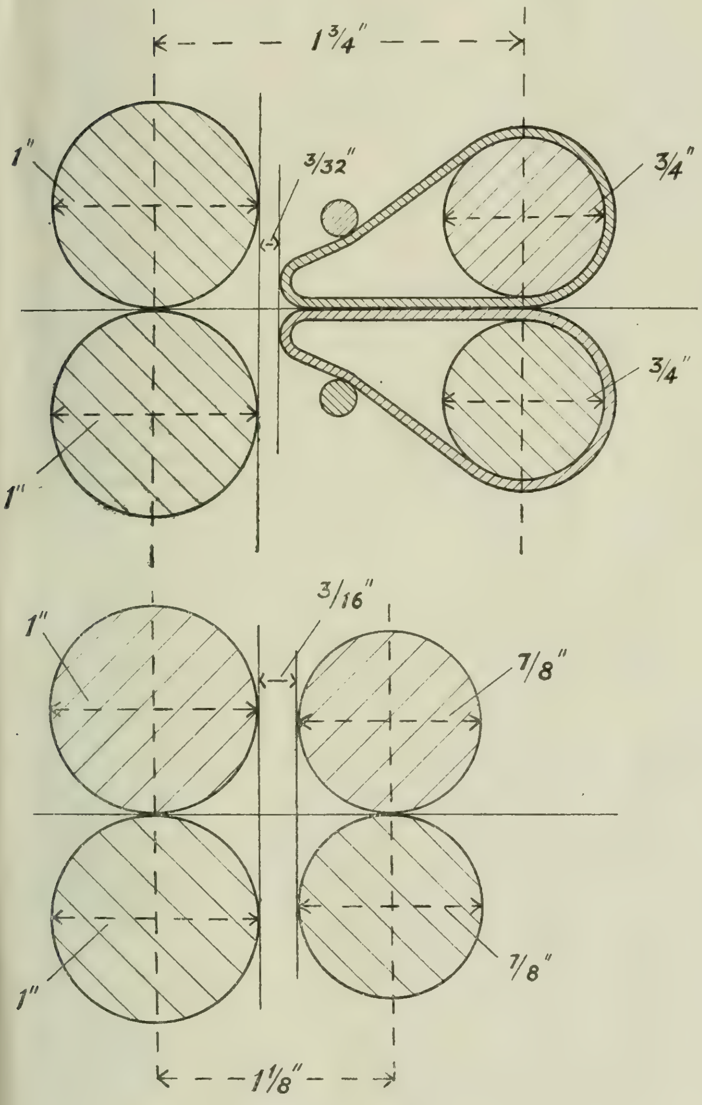
II.

At the outset, the following important distinctions in the yarns produced by these two systems are suggested:—

(1) The final draft of 19·5 in the Casablancas system may involve more drastic treatment of the fibres and thus cause the breakage of an appreciably larger number than occurs in the ordinary system.

(2) The last two stages of the ordinary system of drafting present two opportunities for the rejection of fly. In the Casablancas system the same amount of fly has to be rejected at one stage and it is conceivable that the resulting yarn contains more short fibres.

Fig. 1.



Casablancas System.
Final draft of 19·5.

Ordinary System
Final draft of 7·2

(3) In the Casablancas system, the distance between the front rollers and the leather bands is small in comparison with the distance in the ordinary system, so that the majority of the fibres are gripped by the bands while they are being pulled forward by the front rollers. This method has been said to produce a more even yarn. The possible adverse effects of the final high draft may, however, counter-balance this advantage.

This investigation therefore seeks to decide on two points: (*i*) the relative proportions of short fibre present in the two yarns, (*ii*) the regularity or evenness of the one yarn compared with the other.

III—TENSILE TESTS.

The first method of comparison was based on the consideration that the tensile strengths of two yarns of the same counts and twist per inch, spun from the same cotton and tested under similar conditions, will depend only on the actual lengths of the fibres in the yarns. Thus, if one contains more broken fibre than the other, its tensile strength will be less, because there will be on the average less surface per fibre to exert frictional forces.

In carrying out a series of tensile tests, full precautions were taken to secure that both yarns were tested in the same manner, and that all varying conditions of the atmosphere and of the testing machine affected both yarns equally. A Baer Single-Thread Tensile Tester was employed, the speed of the plunger being regulated to 30 cms. min., and tested at least once a day. The variation of the room temperature during the day affected the viscosity of the oil in the cylinder of the machine, so that the speed of the plunger varied somewhat during the day. This, however, did not adversely affect the tests, owing to the adoption of the following procedure:—Fifty tests performed on one type of yarn were immediately followed by fifty on the other type. As it was found that 100 tests could be performed satisfactorily in about an hour, during which time the atmospheric conditions did not change seriously, any variations in the speed of the piston, or, what is more important, in the relative humidity, would, in the course of a day's work make an equal impression on tests upon both types of yarn. A few of the tests were performed by a second observer, but the influence of any personal factors was thrown by the above procedure to an equal extent on both yarns. Effects merely characteristic of one machine, or even of one bobbin, were ruled out by giving equal weight to tests from each of the 36 bobbins of both kinds of yarn.

The length of the test-piece was chosen to be 3½ inches, the extent of yarn from grip to grip being then 2¼ inches. It was important in this investigation to compare not only the weaker portions of the yarns, but as far as possible the stronger parts also, so that a calculated value of the *irregularity*, and of *mean strength*, should have reference to every part of the yarn, and not merely to a few weak portions of it. Had a greater length been chosen, many very strong portions would never have been revealed, and the irregularity so obtained would have been less useful. On the other hand, a shorter length would introduce effects due to the fibres being gripped at both ends, and, therefore, to their breaking instead of pulling out. The observations would in that case have reference to properties of the fibres and not merely of the yarn.

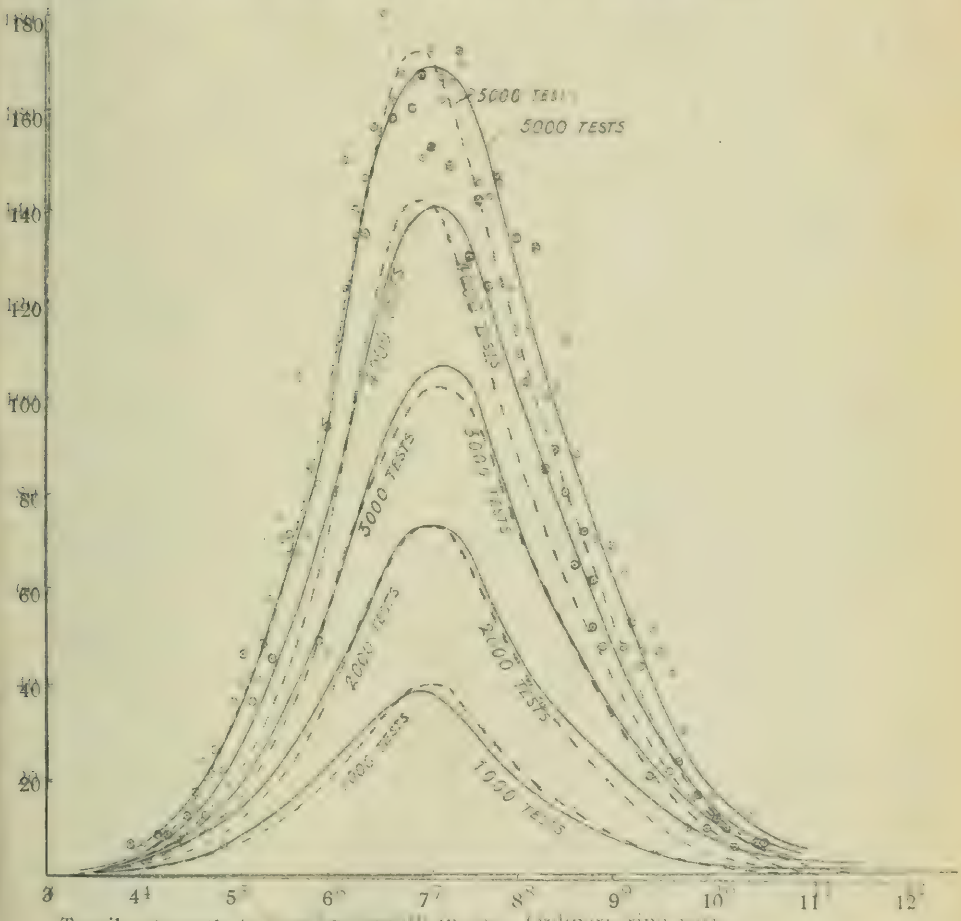
When several thousand tests had been completed, frequency curves of the results were plotted, and the tests were found to lie very approximately on normal *probability curves*, indicating that the usual statistical methods were applicable. A slight skewness (see below) visible in all curves drawn, was not sufficient to invalidate these methods. The means and probable errors were accordingly worked out, and an estimate was made of the number of tests necessary before a possible small difference between the arithmetic means would be made plainly visible. It was shown that this difference was so small that 49,000 observations on each yarn would be required. This was equivalent to finding no real difference. Accordingly, on the completion of 10,000 tests (5,000 on each yarn), the additional

the number of tests necessary before a possible small difference between

results were brought into the calculations and no more were performed. The means with their probable errors were as follows:—

Casablancas: 7·184 ± ·0362 } Difference 0·026 ozs.
Ordinary 7·158 ± ·0371 }

The difference between these two (0·026 ozs.) has a probable error of $\pm\sqrt{(0{\cdot}0115)^2 + (0{\cdot}0114)^2}$ or ±0·0162 so that the difference is only 1·6 times its own probable error. Now, unless a given difference is more than three times its probable error, it cannot be certain that it is not a mere consequence of errors of sampling. The mean strengths of the two yarns must therefore be taken as identical. Smooth curves (Figs. 2a and 2b) drawn between the points of Frequency Polygons of 1,000, 2,000, 3,000, 4,000, and 5,000 observations are shown for both types of yarn. The skewness is just visible but the great similarity between the yarns is very apparent. To indicate the accuracy of the curves drawn, the points, representing actual observations, are left in for the last curves.



Tensile strength in ozs. Casablancas yarn. Ordinary ring yarn.

FIG. 2A.

Skewness of the Frequency Curves.—To determine the amount of the skewness, the quantity (mean-mode)/standard deviation, known as "the skewness," was calculated. To facilitate this determination, the empirical

This investigation therefore seeks to decide on two points: (*i*) the relative proportions of short fibre present in the two yarns, (*ii*) the regularity or evenness of the one yarn compared with the other.

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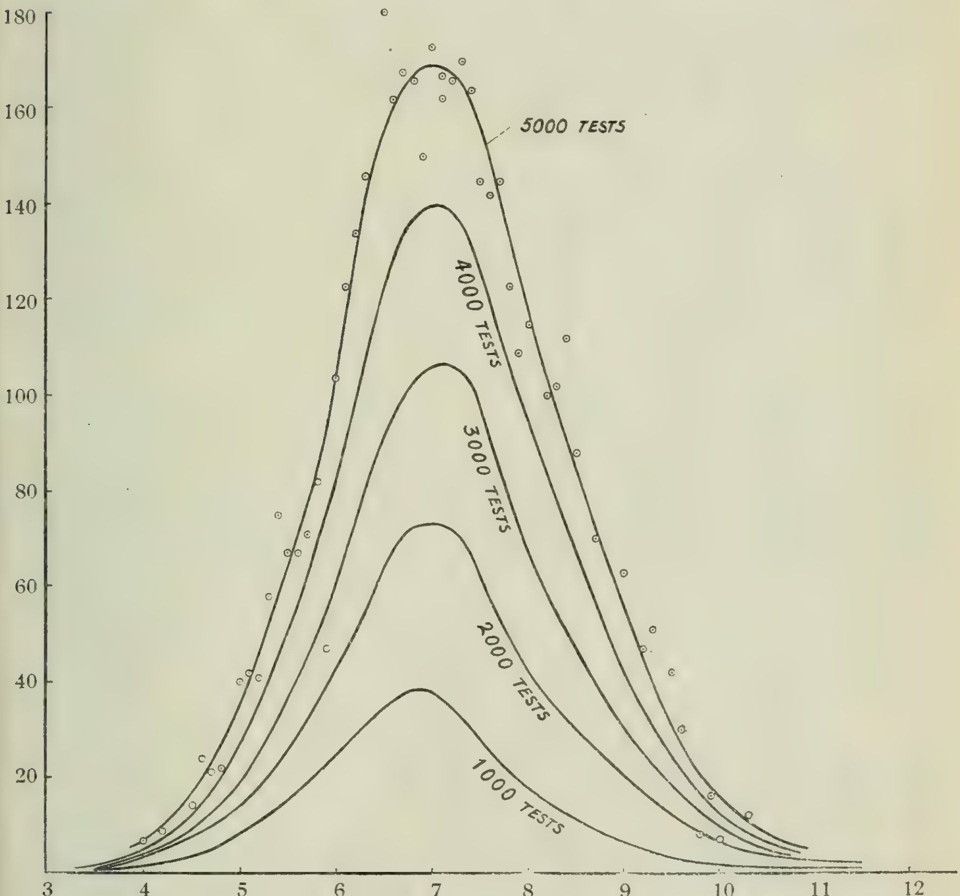
Casablancas :	7·184 ± ·0362	}	Difference 0·026 ozs.
Ordinary :	7·158 ± ·0372		

The difference between these two (0·026 ozs.) has a probable error of $\pm\sqrt{(0{\cdot}0115)^2+(0{\cdot}0114)^2}$, or $\pm 0{\cdot}0162$, so that the difference is only 1·48 times its own probable error. Now, unless a given difference is more than three times its probable error, it cannot be certain that it is not a mere consequence of errors of sampling. The mean strengths of the two yarns must therefore be taken as identical. Smooth curves (Figs. 2a and 2b) drawn between the points of Frequency Polygons of 1,000, 2,000, 3,000, 4,000, and 5,000 observations are shown for both types of yarn. The skewness is just visible, but the great similarity between the yarns is very apparent. To indicate the accuracy of the curves drawn, the points, representing actual observations, are left in for the last curves.



Tensile strength in ozs. Ordinary ring yarn.

FIG. 2B.

Skewness of the Frequency Curves.—To determine the amount of the skewness, the quantity (mean-mode)/standard deviation, known as "the skewness," was calculated. To facilitate this determination, the empirical formula 3(mean-median)/standard deviation, known to be a good approximation, was used. No large error was then made in trying to find the position of the peak of the curve. The following are the " skewnesses "* for the 10 separate thousands, and also for the two sets of 5,000:—

CASABLANCAS.				ORDINARY.			
For 1,000 observations :							
Mean	Median	Stan. Dev.	Skewness	Mean	Median	Stan. Dev.	Skewness
7·17	7·08	1·152	+0·234	7·37	6·95	1·156	+1·09
7·14	7·26	1·133	−0·11	6·94	7·25	1·215	−0·79
7·63	7·62	1·183	+0·02	7·16	7·14	1·258	+0·05
6·81	6·78	1·140	+0·08	7·13	7·13	1·206	zero
7·17	7·09	1·245	+0·20	7·19	7·17	1·271	+0·04
For 5,000 observations :							
7·184	7·150	1·20	+0·085	7·158	7·087	1·230	+0·173

It will be noticed that the skewness is on the whole positive, although very small in the case of the Casablancas. Such a positive skewness would be produced by the presence of an unduly large number of test-pieces of high strength. Two explanations of this effect are possible, either of which, or both, may be operative in producing the skewness:—

(1) A periodically high strength may occur in the yarn, due to the periodic builder motion.

(2) Bunches of parallel fibres may have been distributed unevenly throughout the roving.

There is little evidence that the first effect, which must exist, is the true cause. Some attempts to isolate such a period have shown that the irregularities of the yarn completely mask it (compare Oxley, Trans. Text. Inst., 1922, **13**, 97). Moreover, its effect on both yarns should be the same. It seems likely, on the other hand, that in the Casablancas system, by holding one end of the fibres while they are drafted by the front rollers, these

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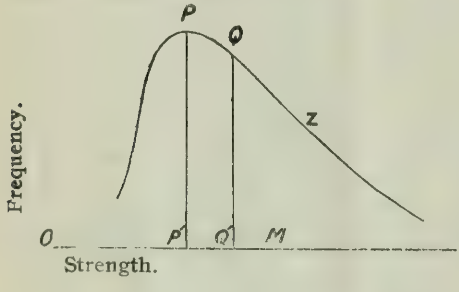
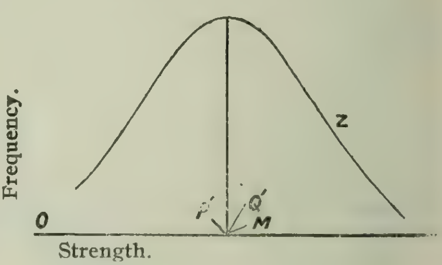
*A note explaining the term *skewness of a frequency curve* will probably be helpful. Suppose the quantity measured, in the above case the tensile strength, is plotted horizontally and the number of occurrences, *i.e.*, the frequency of a given strength is plotted vertically. A curve Z forming the boundary of the plotted points is called the frequency curve. If the maximum of this curve is at P the vertical through P defines a strength OP′ called the *mode*. The vertical through Q which has as many points to the right of it as there are to the left defines a strength OQ′ called the *median*. The arithmetic mean value of the tensile strengths is called the *mean*, OM, and the closeness with which the measurements are concentrated round the mean is called the *standard deviation*.

SKEW CURVE.



NORMAL PROBABILITY CURVE.



The *skewness* of the frequency curve is defined as $\frac{\text{mean—mode}}{\text{standard deviation}}$ or approx. as $\frac{3(\text{mean—median})}{\text{standard deviation}}$. If the mean is greater than the mode, the curve is positively skew. If the frequency curve is not skew, the mean, mode and median coincide, the frequency curve is symmetrical and is a normal probability curve.

rollers are enabled to separate out more efficiently any bunches of fibres in the roving. The effect would then be to diminish the skewness of the curves obtained in the case of the Casablancas yarn. It is noticeable that the ordinary yarn is about twice as faulty, so far as the skewness of its curve is concerned.

Irregularity in the Roving.—Superimposed on the smaller irregularities of the yarns were found some large wave-like fluctuations. In one extreme case, the mean of 50 tensile tests was 5·98 ozs.: in another, 8·68 ozs. The variation of the tests among themselves was in both instances normal, but in the second case the tests were nearly all higher than those in the first. The effect is probably to be explained by irregularities in the undrafted roving. As an important consequence, it becomes difficult to select a " representative sample " of the yarn, and it was possible that, in the tests, undue prominence had been given to a quite exceptionally strong or weak portion. However, separate thousands of tests when plotted showed that no such portion had been included, at any rate not more in one yarn than in the other.

The disconcerting effect of this kind of variation upon the statistics is, however, important. The following less extreme cases will illustrate how quite contradictory results may be obtained.

Case.	No. of Tests.	Mean (ozs.)	P.E.	R. Humidity.
1	50	8·68	±0·0704	62%
	50	6·19	0·0656	56%
2	50	8·19	0·117	60%
	50	6·38	0·078	75%

Subtracting in each case the second from the first, the differences and their probable errors are as follow:—

Case.	Difference of Means.	P.E. of Difference.	Difference of Humidities
1	+2·49 ozs.	±·096	+ 6%
2	+1·81 ozs.	±·141	− 15%

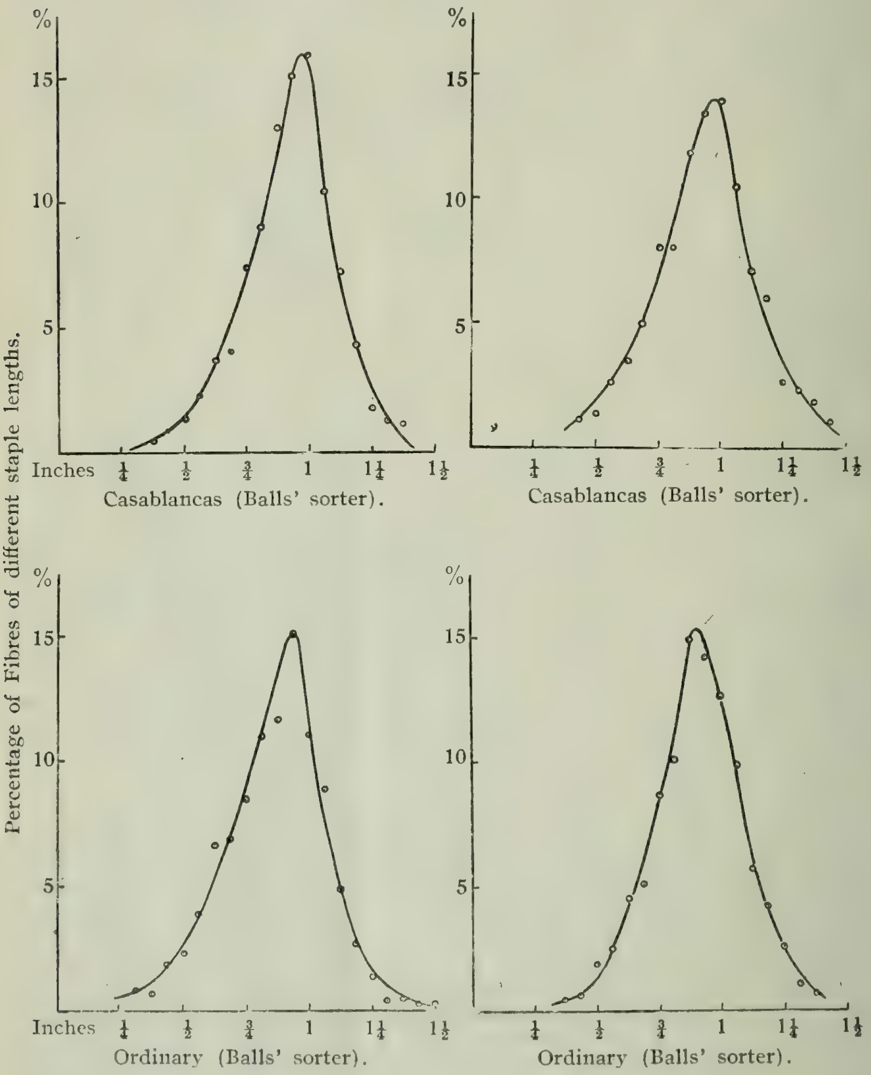
The ratio of the difference between the means to its probable error is in both cases so large as to make it appear statistically certain that the results are not fortuitous. Yet, in the one case, an increase in relative humidity goes with an increase in tensile strength, whilst, in the other case, a decrease in relative humidity accompanies the same effect. The explanation is simply that the yarn, though nominally of the same counts, was actually different in the two instances, because of irregularities in the roving. Such occurrences cast great doubt on any results based on a few observations only, such as the humidity variation calculated by Turner (J. Text. Inst., 1921, **12,** 137-146) from sets of 50 tests.

Irregularity in Strength.—The equality of strength of the two yarns shows at once that no serious difference in the proportions of short fibre exists. The second problem, as to the regularity in strength, is also dealt with by comparison of the two lists of standard deviations already given. It appears from these that the strengths of two yarns are equally irregular. There is, however, a quantity known as " the irregularity " defined as (mean − sub-mean) / mean × 100%, which is in more general use in this connection. The irregularity was accordingly calculated on this basis. Below are two series of values for this quantity, the second series being derived from the same observations by re-arranging the observations so as to make certain that false values of irregularity, due merely to nearly equal observations happening to be grouped together, are not relied on in future work.

IRREGULARITIES %.

CASABLANCAS.			ORDINARY.	
1st Series.	2nd Series.		1st Series.	2nd Series.
12·30	11·52	....	13·18	16·16
10·92	13·01	....	16·82	10·81
12·09	12·80	....	12·93	13·15
11·30	13·37	....	14·74	12·34
13·97	12·38	....	14·43	12·08

From these figures, it is clear that neither yarn is superior in regularity of tensile strength, for the differences within either of the sets are at least as large as the differences between the two sets.



Casablancas (Balls' sorter).

Casablancas (Balls' sorter).

Ordinary (Balls' sorter).

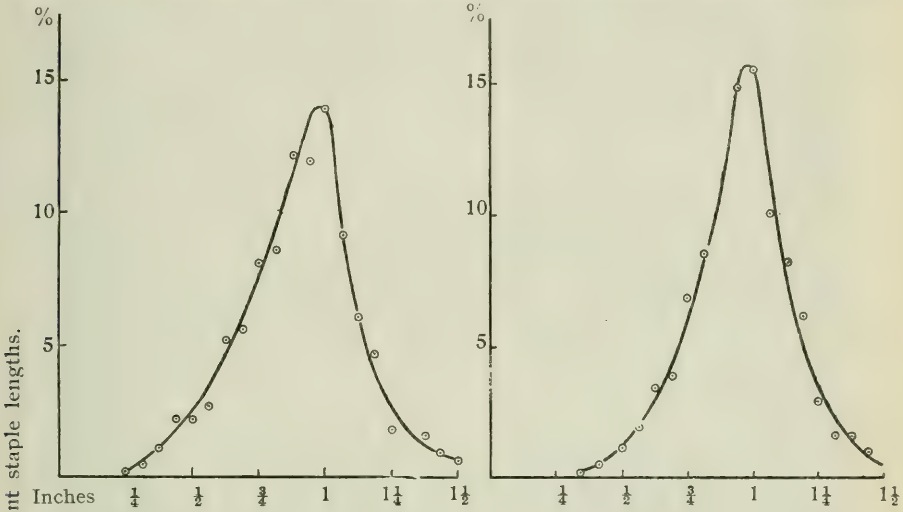
Ordinary (Balls' sorter).

FIG. 3A.

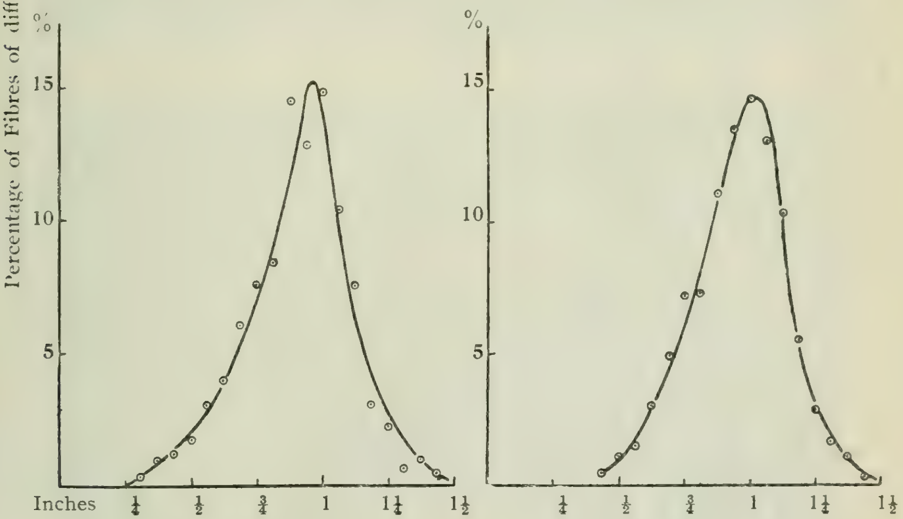
IV.—SHORT AND BROKEN FIBRES.

The main fact of approximate equality in fibre distribution having now been established, it was necessary to carry out a more minute investigation into the quantity of short fibre present. Two methods were adopted, as follows:—

(*a*) *Sorter Analyses:* A yard or two of yarn was cut from several different bobbins, and each yard was wound separately on a rotating spindle. A few inches of the yarn was then unwound, and the spindle set rotating so as to untwist the yarn. After a time, the yarn became loose enough to be pulled down with ease, and then the process of pulling off the spindle and unwinding could be arranged so that the yarn could be continuously unpicked. The first inch pulled was thrown away so that the short pieces produced by cutting the yarn should not be included. Sufficient of each kind of yarn was pulled down to produce about four



Casablancas (Balls' sorter). Casablancas (Balls' sorter).

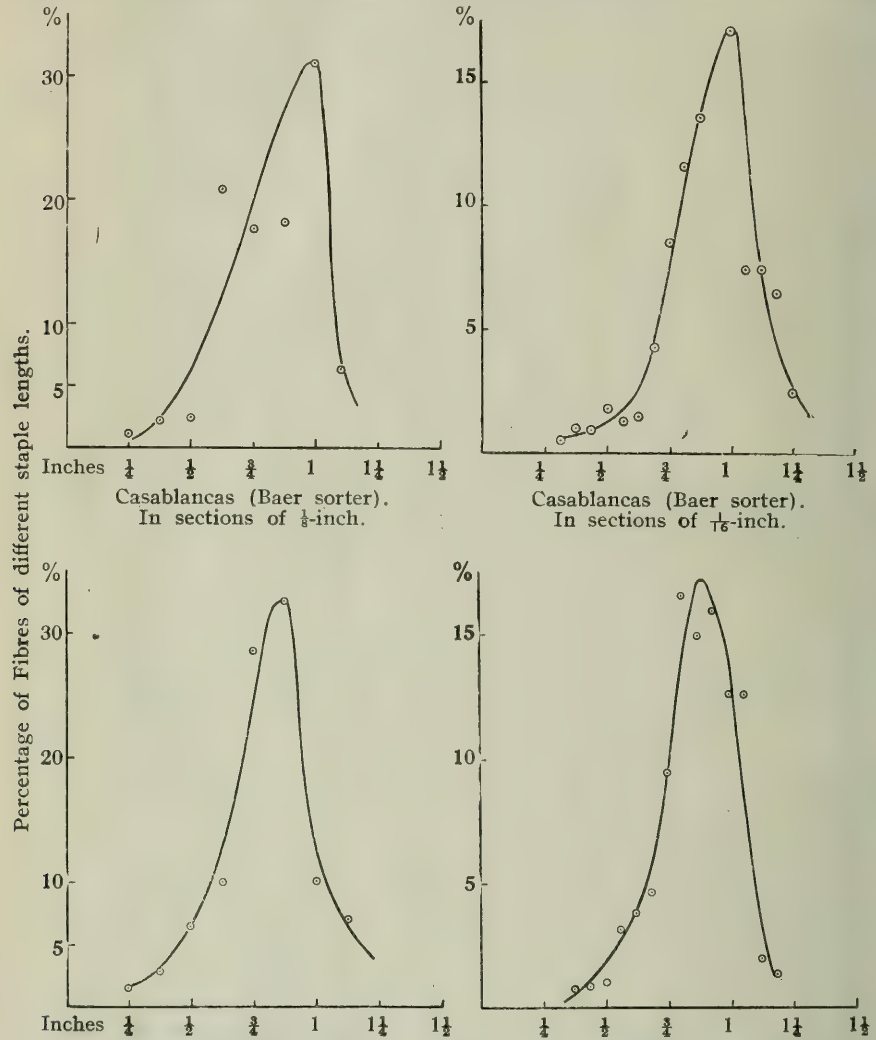


Ordinary (Balls' sorter). Ordinary (Balls' sorter).

FIG. 3B.

grains of fibre from each yarn. Each of these small quantities was passed about a dozen times through the draw-frame of a Balls Sledge Sorter, in order to bring the fibres parallel, and to pull them apart even more thoroughly. They were then analysed on both Balls and Baer Sorters.

Diagrams, showing the results of the analyses, are given (Figs. 3A—3D). It will be noticed that all diagrams agree in making the Casablancas yarn equal to or superior to the other yarn; in several cases, the former is slightly longer in its most frequent staple length. The somewhat erratic results of the Baer sorter are due to the difficulties of laying down the fibres evenly, and of dividing up the "staple-diagram" with sufficient accuracy. On the whole, the staple length of the majority of hairs is $\frac{15}{16}$ ins. in the ordinary, and a trifle more in the Casablancas. A reproduction of four staple diagrams of the Casablancas and ordinary yarn fibres as obtained on the Baer sorter is shown in Plate I.



Casablancas (Baer sorter). In sections of $\frac{1}{8}$-inch.

Casablancas (Baer sorter). In sections of $\frac{1}{16}$-inch.

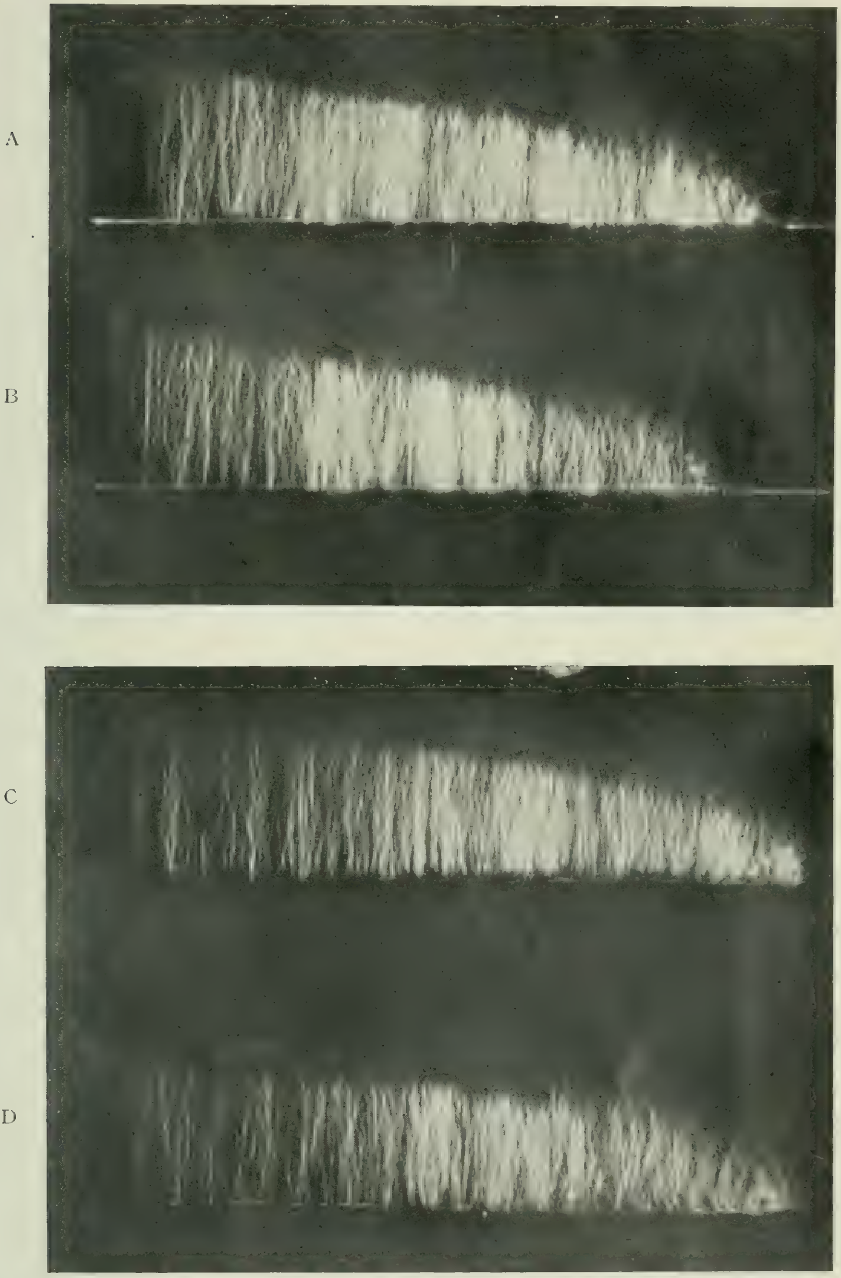
Ordinary (Baer sorter). In sections of $\frac{1}{8}$-inch.

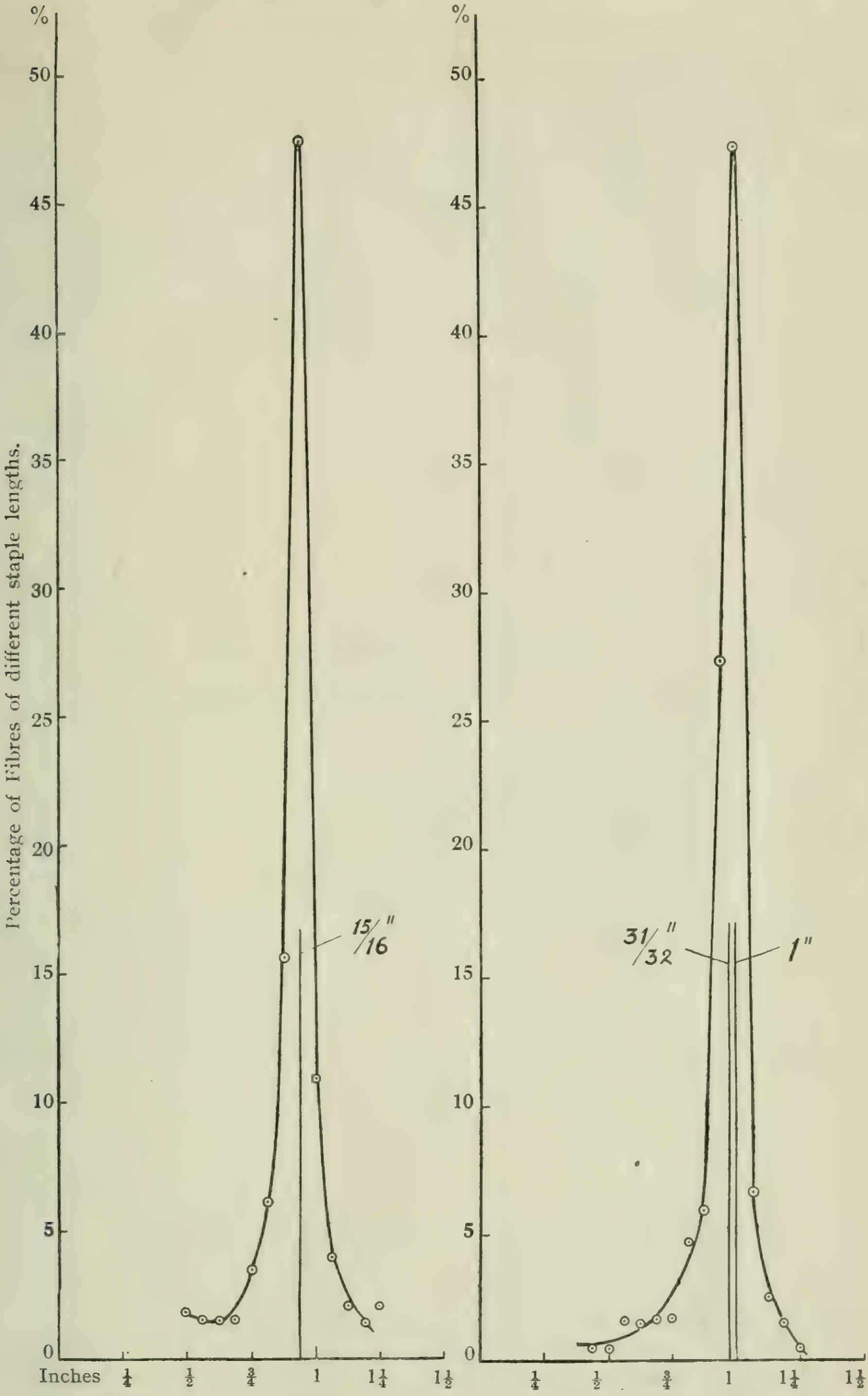
Ordinary (Baer sorter). In sections of $\frac{1}{16}$-inch.

FIG. 3C.

Plate I.

Staple diagrams obtained with fibres taken from Casablancas and ordinary yarn. A and C from Casablancas yarn, B and D from ordinary ring yarn.





Ordinary (Baer sorter).

Casablancas (Baer sorter).

In these diagrams the extreme length of the curves is due to the great uncertainty involved in dividing up the sorter diagram (see Plate II), where the tips of the fibres form a nearly horizontal line. The curious similarity in the *shape* of the above curves is merely due to the careful precautions taken to secure the same treatment for both samples of sorted fibres.

FIG. 3D.

(*b*) *Tensile Tests on Short Specimens:* Since sorter-analyses give somewhat uncertain results for the quantity of *short* fibre present, a further test was considered desirable. This was secured by performing more tensile tests on the Baer tensile machine, but with a very small distance between the grips. The hypothesis was that in such a case, when the majority of fibres were gripped at both ends, the presence of a small extra quantity of short fibre, held at one end only, would have an exaggerated effect on the mean tensile strength. Accordingly, 500 tests were performed for each kind of yarn, at distances between the grips of ¼, ½, ¾, and 1¼ inches, and, in order to obtain a more complete diagram, at 2¼, 3, and 3½ inches. A few were performed with practically no distance at all between the two grips, in order to obtain the mean total fibre-strength of the yarn. For the tests at 2¼ins., 1,000 were at first selected from the 10,000 already performed, but these were found to give a mean considerably lower than the curve connecting the other points. Two further sets of 500 were then performed, and these gave means falling approximately into line with the rest. This appears to indicate some continuous effect of the atmosphere on the yarn, as the 10,000 were performed two to three months previously. The order in which the new tests were done, viz., at ¼, ½, ¾, 1¼, 3½, 3, and 2¼ inches would tend to expose such a conditioning process, by making the final means at 2¼ higher than the curve, while the means at 2¼ selected from the 10,000 should be lower than the curve. This is found to be true in both cases. (Fig. 4.)

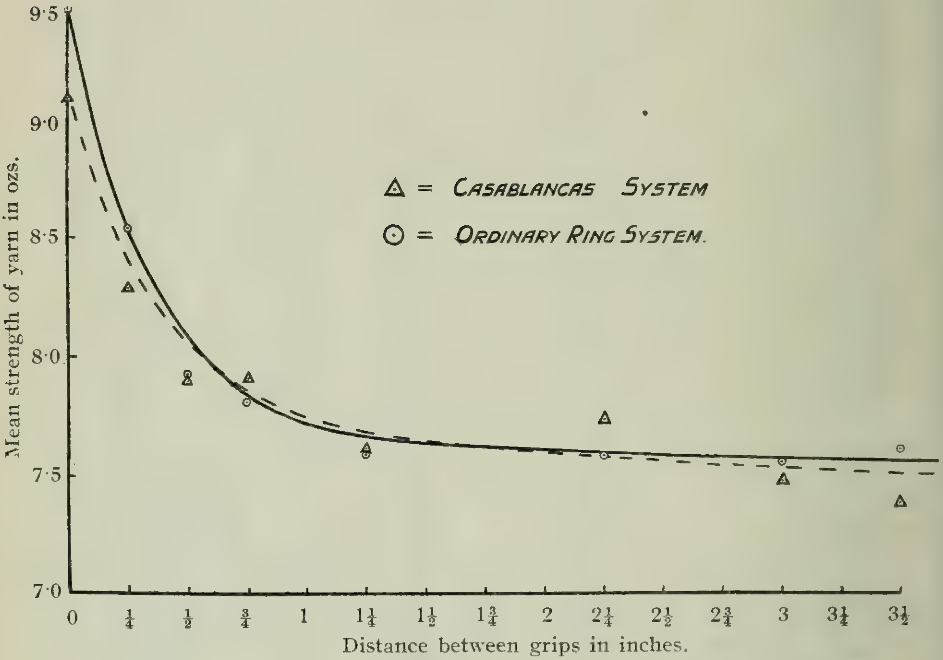


FIG. 4.

The means, with their probable errors, were:—

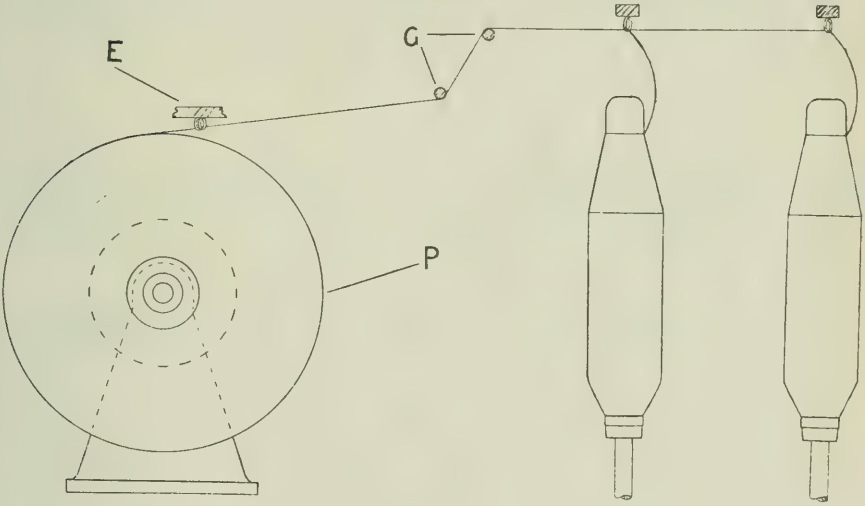
Distance (ins.)	Casab. (ozs.)		Ordinary (ozs.)		Difference	P.E. of Difference
¼	8·299	± 0·045	8·54	± 0·046	–0·24	± 0·064
½	7·90	0·043	7·92	0·059	–0·02	0·059
¾	7·92	0·041	7·81	0·038	0·11	0·056
1¼	7·61	0·039	7·59	0·035	0·02	0·053
2¼	7·79	0·038	7·59	0·034	0·20	0·050
3	7·48	0·035	7·56	0·036	–0·08	0·050
3½	7·42	0·034	7·51	0·038	–0·09	0·051

On the whole, the two yarns are indistinguishable by this method.

V.—SUBSIDIARY DETERMINATIONS.

(1) *Determination of the Counts.*—The object here was not to check the number given by the mill (36's), but to make sure that the counts of both yarns were the same. To do this, it was essential that the weighed lengths of both yarns should have been measured off at precisely equal tension. The method was carried out by means of the apparatus shown in the accompanying diagram (Fig. 5).

ELEVATION.



PLAN.

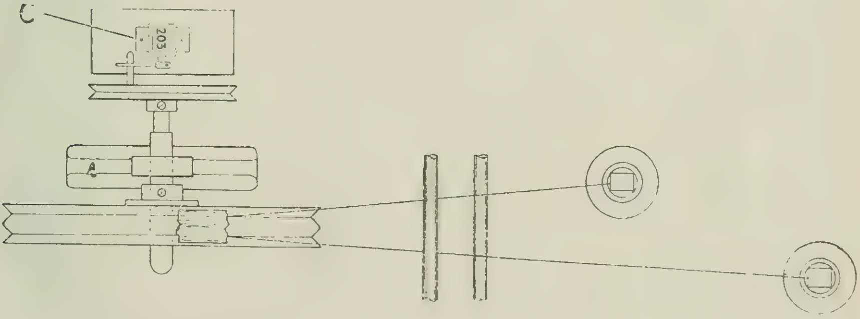


FIG. 5.

Yarn from two bobbins, one of each kind, was taken over two glass rods G, and then through a pair of porcelain eyes E, one thread passing through each eye. The ends were then fixed to the rims of a double pulley, which, on being rotated by a motor, wound on the two yarns at the same rate and tension into the two grooves. The rods G were used to increase the friction somewhat, while E served merely as a guide for the yarn. By means of a revolution-counter C, it was possible to wind off 50 yards of yarn with ease, and to be sure that the equal length of the two yarns had been measured at the same tension. A length of 50 yards was taken in this manner from each of the 72 bobbins, and the samples were weighed on an Oertling balance. The mean weights of 50 yards, and their probable errors, are:—

	Mean wt. of 50 yds.	P.E.	Difference	P.E. of Difference
Casablancas	0·767 grams	±0.0039	0·018 grams	±0·0072
Ordinary	0·749 grams	±0·0034		

The difference, being only 2·5 times its probable error, is not significant and the counts are therefore the same for both, provided that the number of twists per inch is the same, for, if one yarn is twisted more than the other, it will stretch less under the same tension.

(2) *Determination of twists per inch:* This was done on the B.C.I.R.A. twist tester which is an improved design of the tester described in Trans. Text. Inst., 1922, **13,** 81. The results of 300 twist measurements on each yarn were:—

Casablancas: 25·7 ± 0·25 twists per inch.
Ordinary: 26·3 ± 0·27 twists per inch.

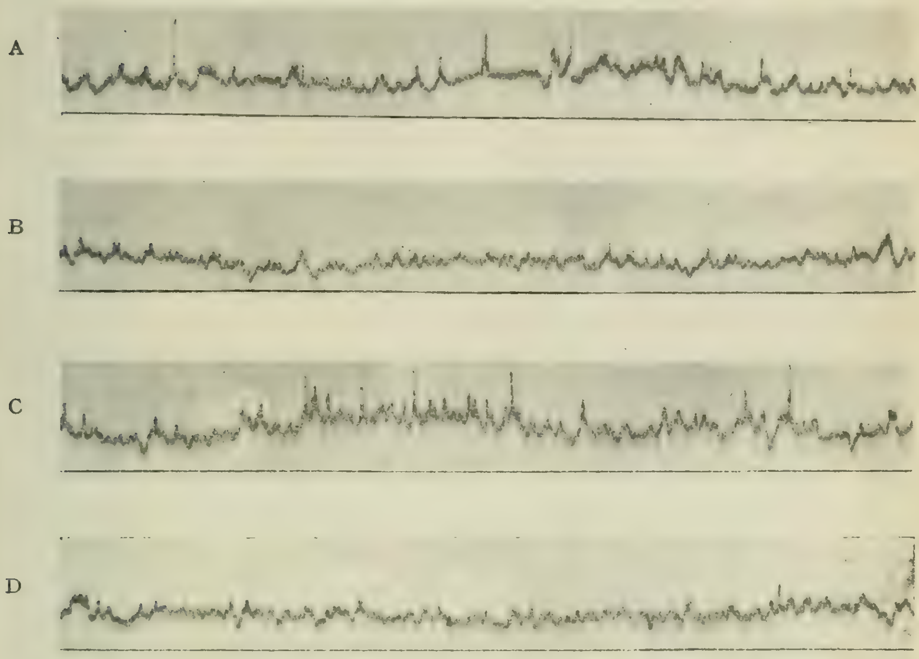
Up to this point, none of the tests had shown any decisive difference between the two yarns, the one or two small differences detected being so doubtful that little reliance could be placed on them as regards a definite conclusion as to which is the superior yarn.

VI.—PHOTOGRAPHIC TESTS: A COMPARISON OF THE REGULARITY OF THE YARNS UNDER COMPRESSION.

A decisive test was obtained by photographing from 70 to 80 yards of each yarn on the Photographic Regularity Tester (see Trans. Text. Inst., 1922, **13,** 54). In the Casablancas system of drafting, the operation of drawing the fibres between the leather surfaces, which have a large area of contact, will probably straighten out the fibres more efficiently than the corresponding operation in the ordinary ring system, in which the rollers are set further apart (see Fig. 1) and the surface of contact is considerably smaller. It may be expected, therefore, that in the Casablancas yarn the fibres will tend to lie more parallel and be less curled than in the ordinary ring yarn. If so, it follows that the ordinary yarn should exhibit small neps, consisting of a few fibres only, more frequently than the Casablancas yarn.

In the photographs, it is somewhat difficult to decide on what may be taken as small neps, but the independent estimates of three different observers agreed in placing many more neps to the account of the ordinary ring yarn than to the Casablancas yarn. The photographs, portions of which are shown in Plate II, were taken while the yarn was under compression. If the parallelism of the fibres in the Casablancas yarn is more pronounced, it may be expected that the yarn will be more compressible than ordinary ring yarn. From a cursory inspection, it was clear that the effect, if any, was very small, but the following method was employed for ascertaining the difference, however minute:—Scales were constructed consisting of millimetre squares, which were intended to measure the mean height (in millimetres) of the black photographic line which represents the upper surface of the yarn under a lateral magnification of 224.* These heights were measured in consecutive columns, of breadth 1 millimetre, which corresponds to 8 millimetres** of yarn. After several types of scale had been tried, it was found best to clamp a millimetre scale on top of the photographs, parallel to and at a known distance from the edge of the paper, and to run the measuring scale along this as a guide. The scale was marked on a thin slip of mica and consisted of 5 millimetre columns each 25 millimetres high. The cleave of mica was cemented to a small square of glass for protection, and moved to the right by 5 millimetres at a time. At every position of the scale, five observations of the height of the photographic trace could be made. (The mechanism in the camera

PLATE II.



Photograph A represents the most irregular portion of the Casablancas yarn.
Photograph B represents the most regular portion of the Casablancas yarn.
Photograph C represents the most irregular portion of the ordinary yarn.
Photograph D represents the most regular portion of the ordinary yarn.
The horizontal black line is the arbitrary base chosen for purposes of measurement.
Lateral magnification 224, Longitudinal contraction 8.
The slopes are increased 1,792 times.

---

* The indicator used in these tests was only $^1/_{10}$th as sensitive as the one described before (*loc. cit.*), where the lateral magnification was 2,240.

** The longitudinal contraction was 8 : 1, as in the earlier work, so that one millimetre along the photographs represents eight millimetres of actual yarn.

was such as to ensure that the lower edge of the sensitive paper was always the same distance from the zero line, *i.e.*, the position of a line drawn by the spot of light when nothing is between the shoes of the instrument.) In this manner, 10,000 observations were made on the photographs—5,000 for each yarn. Frequency curves, similar to those constructed for the tensile strength tests, were drawn and are shown in Fig. 6. Three differences, two of them important, are plainly visible.

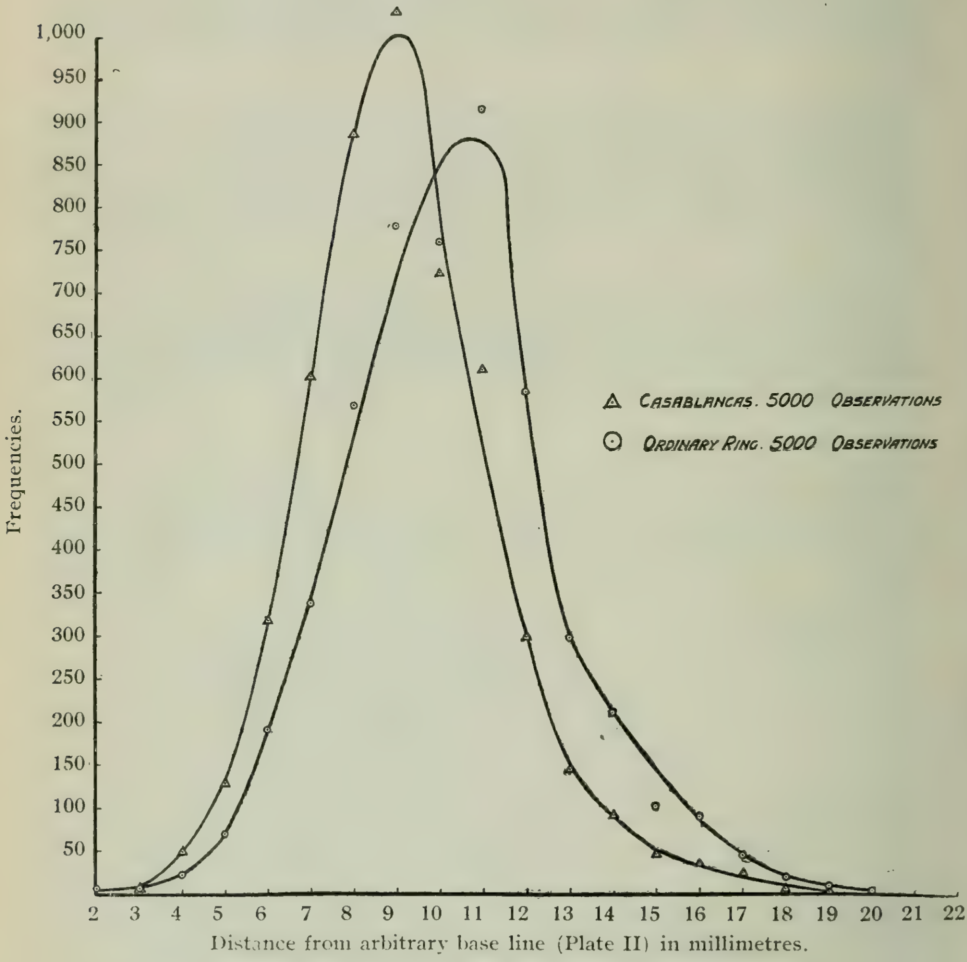


FIG. 6.

(1) *The height of the Casablancas curve is the greater:* Since the number of observations is the same in both cases, this indicates a greater regularity or evenness in the Casablancas yarn. The mean heights, in millimetres, for the two yarns, measured from an arbitrary base line (the black line shown in Plate II), and the probable errors are:—

Casablancas Yarn.	Ordinary Ring Yarn.
9·153 ± 0·021	11·632 ± 0·025

The difference in regularity, indicated by the difference between 0·021 and 0·025, is of statistical significance, for the probable errors of these quantities themselves are 0·00021 and 0·00025 respectively, so that the difference, 0·004, is at least 10 times its probable error. Therefore, the indications are that ordinary ring yarn spun under the conditions described is undoubtedly slightly inferior to the Casablancas yarn in point of regularity as measured on this tester.

(2) *The Casablancas yarn is definitely more compressible:* The difference between the means is no less than 75 times its probable error. As the twist in both yarns is the same, this points to the fibres having been more straightened in the Casablancas yarn with the result that under compression they tend to fit more closely beside one another than do the overlapping fibres in the ordinary ring yarn.

(3) *Skewness of the frequency curves:* The third difference, of less importance, can be explained on the assumption that the fibres in the Casablancas yarn have been pulled straighter than the fibres in the ordinary ring yarn. When a length of yarn is drawn between the compressing shoes of the regularity tester, a curled or stray fibre will often be rolled back on itself, until, being trapped by other fibres, it forms a minute knot. Under this form, it passes between the shoes, producing a slightly more incompressible portion and a high part on the photograph. A large number of such small tangles would tend to make the frequency curves positively skew, and it would be anticipated that the ordinary ring yarn would give the more skew curve. The skewness was therefore measured, as before, with the following result:—

	Casablancas Yarn.	Ordinary Ring Yarn.
Skewness	0·218	1·540

The curve for the ordinary ring yarn exhibits a skewness eight times as large as that for the Casablancas yarn.

The actual magnitudes measured by this tester are very small, but this fact does not affect the conclusions, as the variations in these quantities are generally even smaller. Thus, as the vertical distances on the photographs are magnified 224 times, the difference between the means amounted to 0·00112 cm. only, but the probable error of this quantity is merely 0·000015 cm. Therefore, on the whole, the Casablancas yarn was compressed by about a fibre's breadth more than the ordinary ring yarn in passing through the shoes. The probable error just mentioned is only 0·006 of a fibre's breadth.

CONCLUSIONS.

The conclusions to be drawn from the foregoing observations, which include 14,000 tensile tests, 600 twist tests, 72 determinations of counts, 16 sorting tests, and 10,000 observations on the photographs indicate that:—

(1) The Casablancas system can produce a draft of 19·5 in the final operation of spinning rather more efficiently than the ordinary ring system can produce in the final operations with a rover draft of 2·7 and a ring frame draft of 7·2, making a total draft of 19·4. In yarn produced on the former system, the fibres are distributed a little better and are laid straighter and probably more parallel than they are in the yarn produced on the latter system, the difference, however, being very slight.

(2) The mean length of the fibre is, on the whole, a trifle greater in the Casablancas yarn, as shown by the sorting tests made on the pulled-down yarn, this being due either to more efficient rejection of

fly or to more gentle treatment in drafting. Again, the difference is only just perceptible.

(3) The photographic tests, made on the regularity tester, show definitely that the Casablancas yarn is in some respects more even, particularly as regards the diameter measured under compression.

(4) In all other respects, namely, strength, count, and twist per inch, as far as the above tests go, the two yarns have identical properties.

N.B.—The 600 twist tests described in V(2) were made by Mr. Partington.

REFERENCES TO PREVIOUS WORK.

The advantages and disadvantages of the two methods of drafting and the characteristics of the yarns produced by them have been discussed by J. E. Lees, Textile Recorder, Jan. 14, 1922. It is also interesting to note a remark by E. D. Walen, Textile World, Vol. LXII, No.15, p.138, 1922, who states: " We have available a series of tests made at Barcelona on the Casablancas system and on the ordinary system. These tests indicate a slightly superior yarn from the Casablancas system, and the long draft used indicates a cheaper manufacturing process."

[Received for publication, 15/11/22.

"SOME PHYSICAL MEASUREMENTS ON COTTON FIBRES, AND THEIR GRAPHICAL REPRESENTATION."

(To the Editor).

Sir,

Will you allow me to point out what I believe to be an error in Dr. Barratt's paper in your October number?

Dr. Barratt forms a number of frequency curves from measurements of the lengths, diameters, breaking stresses and " extensions at break " of fibres of two kinds of cotton. As a measure of the uniformity of any one property of one lot of fibres, he puts alongside the experimental curve a theoretical curve based on a formula due to Bateman, comparison of which with the experimental curve " enables one to say with certainty whether the uniformity exhibited is better or worse than what we may call the average."

Two *a priori* considerations throw grave suspicion on the validity of Dr. Barratt's procedure. In the first place the degree of uniformity of, say, the lengths of the fibres of a particular sample of cotton is a definite property of that sample, just as is the actual average length of the fibres, and it is as unreasonable to set up an absolute standard for the one property as it would be for the other. The Gauss Formula recognises this, as it contains a constant which is a measure of the degree of uniformity. The Bateman formula contains no such constant, so that its applicability seems highly improbable.

In the second place, the Bateman formula applies essentially to discrete phenomena—to things which are *counted*—not to things which are *measured* in terms of some arbitrary unit. Though it is not inconceivable that such a formula (even though it contained a factorial!) might be applied to quantities such as lengths and forces, the legitimacy of such application demands careful examination.

Such an examination reveals at once the fallacy underlying Dr. Barratt's procedure. The fallacy lies in the fact that the relation between the experimental and theoretical curves depends upon the size of the class-interval chosen—a small interval favouring the theoretical curve, a large one the experimental curve. The proof of this is quite simple. Dr. Barratt uses the class-interval as a basis for converting the physical magnitudes into numbers for substitution in the Bateman formula. Let us consider how the relative heights of the "peaks" of the two curves will be affected by changing the size of the class-interval; say by halving the size. The peak of the experimental curve will be halved in height. The peak of the theoretical curve will be less affected, being diminished by roughly 30%.* Hence, halving the class-interval will favour the theoretical curve. Thus if for a certain size of interval the two curves coincided then if the interval were halved the peak of the theoretical curve would be 40% higher than that of the experimental curve. Thus the approximate coincidence between the two curves in B_4 (p.227) is a mere accident due to a choice of ·3 mm. for the class-interval. If the measurements had been more numerous (say 1,000 instead of 100) a smaller interval would have been chosen, and according to Dr. Barratt's criterion the uniformity exhibited by the experimental results instead of being "average" would have been decidedly "below the average."

Though the Bateman formula does not apply to examples of this kind. Dr. Barratt has done valuable service in drawing attention to it. The formula has evidently a number of useful applications. Speaking generally, we may say that it can be used to determine whether the irregular recurrence of any event (in time) or any physical feature (in one-dimensional space) is due to mere chance or to the irregular variation of some controlling factor. The reading of Dr. Barratt's paper suggests many applications of this kind.

Yours, etc.,

S. A. SHORTER.

Leeds,
November 14th, 1922.

*The precise effect will depend upon the ratio of the average value to the class-interval, but where this is a moderately large number, it follows from Stirling's theorem that the height of the peak will be proportional to the square root of the size of the class-interval.

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* * *

ABSTRACTS AND INDEX

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22,826	20	170,956	42	173,232	84	177,868	142	181,549	201
146,225	106	171,111	30	173,244	100	177,926	149	181,561	199
161,564	56	171,124	37	173,366	84	178,121	144	181,694	199
157,220	178	171,131	69	173,392	85	178,151	144	181,758	199
168,817	10	171,138	33	173,397	91	178,219	146	181,785	199
168,934	11	171,141	33	173,405	92	178,280	144	181,817	201
168,986	7	171,188	33	173,406	92	178,350	147	181,846	201
168,995	19	171,215	33	173,416	100	178,390	146	181,900	197
169,099	11	171,239	29	173,42[illegible]	88	17[illegible] 470	145	181,901	197
169,153	10	171,261	34	173,4[illegible]	88	178,478	144	181,902	208
169,160	7	171,274	33	173.429	85	178,481	144	181,960	199
169,166	11	171,277	33	[illegible]	84	178,487	144	181,970	199
169,223	7	171,287	37	173,[illegible]55	10[illegible]	178,561	143	182,166	200
169,230	7	171,351	32	173,536	[illegible]	178,570	149	182,502	200
169,237	19	171,482	30	173,572	105	178,596	147	182,507	200
169,248	17	171,483	37	173,589	105	178,610	144	182,575	209
169,277	19	171,591	38	173,591	81	178,801	160	182,776	208
169,293	5	171,602	33	173,592	106	178,817	180	182,799	202
169,318	11	171,632	61	173,696	105	178,821	180	182,815	200
169,407	4	171,638	60	173,775	101	178,890	180	182,830	208
169,469	4	171,650	58	173,776	100	178,946	165	182,844	208
169,524	11	171,673	63	173,893	98	179,194	259	182,979	200
169,530	11	171,704	63	173,938	101	179,217	162	182,992	202
169,551	7	171,719	58	173,971	98	179,234	160	183,021	200
169,560	11	171,726	90	174,068	99	179,260	165	183,227	202
169,588	7	171,776	99	174,122	99	179,282	161	183,235	201
169,600	11	171,801	59	174,230	101	179,363	180	183,249	209
169,603	11	171,806	105	174,263	101	179,384	164	183,319	208
169,631	10	171,826	58	174,412	84	180,017	202	183,424	208
169,659	10	171,891	91	174,456	106	180,060	177	183,868	226
169,690	12	171,987	63	174,499	105	180,063	177	183,869	222
169,695	20	172,012	150	174,503	99	180,178	177	183,882	220
169,710	20	172,019	86	174,508	101	180,187	202	184,031	223
169,741	43	172,038	99	174,660	98	180,325	182	184,128	226
169,758	131	172,152	64	174,671	102	180,351	178	184,186	223
169,905	12	172,193	90	174,902	101	180,502	178	184,197	220
169,998	4	172,197	63	174,960	124	180,529	203	184,256	226
169,999	5	172,238	90	174,961	124	180,669	182	184.309	223
170,038	7	172,278	64	174.973	124	180,691	203	184,316	223
170,090	12	172,286	59	175,096	124	180,712	178	184,319	223
170,121	19	172,315	64	175,310	130	180,720	203	184,339	223
170,130	8	172,343	59	175,450	125	180,761	203	184,386	222
170,142	12	172,357	61	175,485	182	180,773	203	184.449	222
170,171	12	172,402	58	175,486	182	180,793	203	184,450	222
170,201	10	172,407	63	175,741	131	180,815	203	184,488	221
170,273	18	172,485	100	175,746	131	180,873	203	184,533	220
170,285	8	172,493	92	175,761	124	181,100	182	184.537	223
170,313	56	172,515	88	175,768	131	181,155	178	184,578	225
170,370	32	172,598	100	175,883	124	181,197	176	184,610	244
170,473	32	172,638	88	176,034	131	181,198	176	184,788	225
170,529	69	172,782	84	176,535	131	181,226	178	184,825	244
170,608	32	172,847	87	176,745	126	181,330	176	184,829	246
170,626	37	172,851	105	176,869	131	181,391	208	184,842	246
170,645	30	172,870	87	176,880	124	181,392	208	184,867	246
170,696	38	172,994	92	176,922	126	181,393	208	184,922	246
170,767	37	173,017	84	176,953	124	181,394	208	185,158	247
170,775	32	173,078	88	177,017	144	181,395	208	185,238	245
170,849	32	173,101	88	177,182	144	181,410	201	185,246	246
170,865	32	173,122	81	177,210	146	181,441	201	185,393	246
170,869	30	173,132	81	177,211	149	181,479	199	185,433	244
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1,359,112R	13	1,392,807	38	1,397,860	90	1,401,712	87	1,415,286	147
1,385,724	132	1,392,817	38	1,397,905	59	1,401,720	87	1,415,322	147
1,389,627	18	1,392,818	38	1,397,927	59	1,401,984	82	1,415,513	150
1,389,672	11	1,393,003	42	1,398,043	90	1,401,901	149	1,415,583	146
1,389,823	12	1,393,025	38	1,398,103	62	1,402,033	87	1,415,964	165
1,389,883	5	1,393,039	38	1,398,396	91	1,402,038	87	1,416,095	204
1,389,906	18	1,393,197	6	1,398,444	62	1,402,067	92	1,416,186	180
1,389,921	8	1,393,296	43	1,398,532	62	1,402,288	90	1,416,344	180
1,390,081	8	1,393,397	38	1,398,570	62	1,402,357	82	1,416,410	180
1,390,093	18	1,393,539	39	1,398,590	62	1,402,359	83	1,416,510	162
1,390,100	5	1,393,643	38	1,398,599	56	1,402,370	83	1,416,894	180
1,390,103	12	1,393,758	38	1,398,694	62	1,402,376	83	1,416,951	162
1,390,114	5	1,393,819	29	1,398,699	61	1,402,379	87	1,417,206	165
1,390,162	12	1,393,926	[illegible]	1,398,713	85	1,402,394	88	1,417,220	163
1,390,164	12	1,393,951	[illegible]	1,398,752	62	1,402,485	83	1,417,289	180
1,390,173	4	1,393,955	30	1,398,813	86	1,402,532	92	1,417,290	162
1,390,253	18	1,394,050	39	1,398,821	85	1,402,538	83	1,417,455	161
1,390,254	18	1,394,093	39	1,398,865	86	1,402,569	84	1,417,456	161
1,390,267	13	1,394,175	39	1,[illegible]8,877	69	1,402,584	92	1,417,869	165
1,390,292	13	1,394,265	39	1,[illegible],930	56	1,402,670	82	1,417,914	203
1,390,325	13	1,394,270	39	1,399,025	59	1,402,697	82	1,418,610	225
1,390,413	13	1,394,341	39	1,399,121	86	1,402,705	83	1,418,617	203
1,390,512	17	1,394,431	39	1,399,231	91	1,402,724	81	1,419,192	162
1,390,660	19	1,394,637	64	1,399,237	85	1,402,729	83	1,419,714	160
1,390,827	13	1,394,652	64	1,399,278	85	1,402,765	106	1,419,776	163
1,390,921	14	1,394,668	34	1,399,298	86	1,402,819	98	1,420,162	176
1,390,922	5	1,394,829	34	1,399,332	60	1,402,918	102	1,420,271	179
1,390,943	13	1,394,869	63	1,399,418	59	1,403,067	102	1,420,530	179
1,390,957	19	1,394,970	64	1,399,557	59	1,403,180	99	1,421,081	202
1,391,033	13	1,395,010	64	1,399,657	59	1,403,181	99	1,421,172	202
1,391,043	13	1,395,011	64	1,399,690	60	1,403,221	106	1,421,241	202
1,391,246	6	1,395,012	64	1,399,904	86	1,403,229	101	1,421,290	182
1,391,247	8	1,395,054	30	1,399,924	91	1,403,262	98	1,421,613	207
1,391,266	14	1,395,150	42	1,400,009	83	1,403,332	102	1,421,700	208
1,391,276	20	1,395,165	43	1,400,016	92	1,403,354	99	1,421,707	176
1,391,431	43	1,395,213	34	1,400,026	83	1,403,386	99	1,422,242	207
1,391,435	13	1,305,223	34	1,400,159	91	1,403,403	98	1,422,581	177
1,391,512	8	1,395,230	65	1,400,163	86	1,403,785	125	1,423,041	207
1,391,540	8	1,395,382	29	1,400,180	86	1,403,931	126	1,423,175	179
1,391,682	14	1,395,529	34	1,400,293	91	1,404,242	130	1,423,619	179
1,391,712	19	1,395,644	31	1,400,318	86	1,404,467	130	1,423,670	202
1,391,785	14	1,395,669	42	1,400,403	87	1,404,589	130	1,424,025	202
1,391,928	14	1,395,818	64	1,400,417	91	1,404,597	130	1,424,212	207
1,391,943	14	1,395,877	35	1,400,446	91	1,404,700	139	1,424,265	198
1,391,958	14	1,395,904	40	1,400,459	81	1,405,096	126	1,424,276	201
1,391,961	14	1,395,961	63	1,400,522	81	1,405,452	126	1,424,620	198
1,392,029	14	1,395,964	64	1,400,529	87	1,405,511	126	1,425,288	201
1,392,067	9	1,396,012	56	1,400,645	91	1,405,560	126	1,425,363	199
1,392,097	5	1,396,060	90	1,400,675	91	1,405,573	122	1,425,520	201
1,392,125	15	1,396,142	56	1,400,711	87	1,406,253	126	1,425,654	198
1,392,126	14	1,396,154	61	1,400,941	86	1,406,474	123	1,426,351	202
1,392,154	15	1,396,602	60	1,400,982	81	1,406,710	130	1,427,056	199
1,392,264	37	1,396,665	61	1,401,076	81	1,406,835	126	1,428,246	198
1,392,265	37	1,396,669	63	1,401,179	83	1,407,012	126	1,428,572	222
1,392,282	8	1,396,670	63	1,401,439	81	1,407,121	126	1,428,786	223
1,392,323	69	1,396,671	63	1,401,501	87	1,407,343	126	1,429,127	222
1,392,515	34	1,396,672	63	1,401,515	83	1,407,684	126	1,429,519	222
1,392,551	36	1,396,673	56	1,401,516	83	1,408,350	123	1,429,775	226
1,392,552	69	1,396,792	68	1,401,517	83	1,409,184	131	1,430,023	222
1,392,657	38	1,396,960	69	1,401,518	83	1,409,892	125	1,430,115	226
1,392,723	43	1,397,001	56	1,401,519	83	1,412,763	124	1,430,163	226
1,392,743	33	1,397,069	61	1,401,520	83	1,412,949	207	1,430,286	222
1,392,803	38	1,397,257	56	1,401,521	83	1,413,154	208	1,430,523	226
1,392,804	38	1,397,283	58	1,401,522	83	1,414,029	130	1,431,372	245
1,392,805	38	1,397,286	61	1,401,663	92	1,414,031	130	1,433,256	248
1,392,806	38	1,397,299	62	1,401,665	87	1 414,905	145	1,433,276	250
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442,285	144	513,736	34	516,817	85	521,875	149	527,804	221
512,622	40	515,443	81	517,655	123	523,764	233	527,900	221
512,804	64	515,491	85	518,056	130	524,536	222	527,941	222
512,986	36	515,502	75	518,069	123	524,543	221	528,465	149
513,799	40	515,576	101	518,077	130	524,865	199	528,922	247
513,118	8	515,863	105	518,535	122	525,509	202	529,784	247
513,400	9	516,320	65	520,837	145	525,568	220	530,377	247
513,449	9	516,698	88	520,864	147	526,057	223	530,474	246
513,594	19	516,789	122	520,897	143	527,566	222		

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302,459	124	314,403	130	340,824	131	347,276	131	350,638	238
310,695	124	327,912	160	342,610	126	347,849	182	350,804	183
312,301	149	336,558	43	343,675	138	348,194	150	351,370	201
313,541	131	337,672	197	347,130	150	349,179	150	351,452	201
314,311	138	340,287	6	347,131	149	349,655	149	352,830	221

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No. 1—January	P 9		31		*For* " Eighteen " *read* " Eighty."
No. 2—February	A 27	2		9	*For* " Test " *read* " Text."
No. 7—July	T142			5	*After* " p " *insert* " 146."
No. 7 July	T142			1	*After* " p " *insert* " 146."
No. 10—October	A216	1	3		*For* " 1922 " *read* " 1921."
No. 12—December	T230				*In* Table I. *read* 74 for .74.
No. 12—December	T239	-			*In* Fig. 2, Ordinates represent volume, not sectional area.

THE JOURNAL OF THE TEXTILE INSTITUTE

ABSTRACTS

NOTES.—In the references to publications abstracted the name of the publication is followed by the Year, Vol., and Page No. (or Nos.).

In regard to abstracts of patents, the references include the No. of the Patent and the date of acceptance of complete specification, followed by the application number and year.

Literature relating to the composition and manufacture of dyestuffs is not dealt with in the abstracts in this *Journal*.

1.—FIBRES AND THEIR PRODUCTION.

(A)—MINERAL.

Asbestos: Demand for— —in Quebec. Text Merc., 1921, **65**, 564.

The production of asbestos during 1920 amounted to 179,891 tons, valued at $14,749,048, or an increase of 32.3% in quantity and 35% in value, as compared with the previous year, when the shipments amounted to 135,862 tons, valued at $10,932,289. The previous largest tonnage was produced in 1918, when 142,375 tons was shipped, the value of which amounted to $9,019,899. These figures are exclusive of the "Asbetic," a by-product, consisting of very short fibre and rock dust, recovered in the course of the milling of the asbestos rock. —L. M. S.

(B)—ANIMAL.

Silk Cultivation in China. Text. Mfr. (from Chefoo Trade Report of Chinese Maritime Customs), 1921, **47**, 315.

Describes the work of the International Commission for the Improvement of Silk. Vast tracks of oak-growing land lying waste have been discovered. Free acorns have been supplied to oak-growers and in some places mulberries are being planted in thousands. Wild silk worms appear to suffer from more diseases than mulberry worms and, as the eggs are laid only a few days before hatching, time for investigation is limited. —F. G. P.

Border-Leicester Sheep. J. Wood. Wool Rec., 1921, **20**, 1451-1453, 1527-1529.

The Border-Leicester sheep is stated to be a lineal descendant of the Dishley Leicesters. The appearance of the sheep is described. When mature the carcase weighs 100 to 120 lbs., and the fleece from 8 to 12 lbs. The Border-Leicester excels as a crossing sheep—notable crosses are with the Cheviot and Blackface. In the Colonies the Border-Leicester is extensively used, the value of the wool from Border-Leicester-Merino cross being equal to that of the Lincoln-Merino cross. —F. P.

Angora Goat in S. Africa. E. R. Hobson. Wool Rec., 1921, **20**, 1530-1535, 1591-1592.

The development of the mohair industry in S. Africa is traced from the introduction of mohair goats from Asia Minor in 1838. There are three types of pure S. African Angoras—the robust, medium, and fine haired—the weight of fleece and fineness of the hair being also in that order. —F. P.

Sericulture in Argentina. Women's Wear, N.Y., 1921, **23**, 7.

In spite of the efforts made to induce the people to start the silk industry by distribution of free silk worms, the Ministry of Agriculture now informs the growers that there is no market in the country or abroad for the cocoons, which, it is said, cannot compete either in quality or price with those of Europe or Asia. —F. G. P.

Sericulture Resumed by Roumanian Government. Women's Wear, N.Y., 1921, **23**, 7.

As the result of post-war efforts to re-start silk growing it is stated that there are 2,000,000 mulberry trees, and that 300-400 kilos of seed can be raised. The districts of Bunat and Transylvania are especially suited to the industry; there is a Government filature at Lugoj. Efforts to educate the farmers are to be resumed. A very high tariff on silk goods—500-600 lei per kilo—is expected to greatly stimulate home production. —F. G. P.

Sheep; Pure-bred——in America. Wool Rec., 1921, **20**, 1313.

At the fourteenth census taken on January 1, 1920, there were 463,504 pure-bred sheep in the United States. This total was divided amongst the following breeds:—Cheviot 2,969, Dorset Horn 8,412, Hampshire Down 51,813, Leicester 743, Lincoln 13,849, Merino 59,876, Oxford 16,589, Rambouillet 106,819, Shropshire 124,453, Southdown 8,367, Suffolk 723, other breeds not specified 68,891. The total number of sheep on farms in the United States included in the census returns was 35,033,516. —F. P.

Blackfaced Wool; Improvement of——. C. Ewart. Wool Rec., 1921, **20**, 1,595.
The wool of the two mountain breeds, blackface and Herdwick, often contains much coarse hair, but there is no difficulty in selecting animals from flocks on any farm which have fleeces consisting mainly of wool and not of hair. The quality of the wool can be thus improved by careful selection without in any way reducing the mutton-producing qualities. Another method of improving the wool is to cross the breed with another animal which produces wool of a high quality. The first crosses do not give animals of fixed type, but by crossing persistently for several generations animals can be obtained with the necessary wool characteristics and with the other points desired which will breed true to type. Through time, sheep evolved in this way would breed much truer to type than sheep bred in the ordinary way, and a much greater price could be obtained for the improved wool. —W. D.

(C)—VEGETABLE.

Cotton in the Argentine Chaco. U.S. Commerce Reports, 1921, No.149, 1794.
An account is given of the efforts which have been made to stimulate the growing of cotton in the Chaco territory within the last few years. —L. M. S.

Hemp Stripping in the Philippines; Use of Machines for——. U.S. Commerce Reports, 1921, No.155, 77.
It is stated that many hemp stripping machines of a simple type are in operation on the hemp plantations of the Davao Gulf region of Mindanao. —L. M. S.

Cotton Crop in Colombia. U.S. Commerce Reports, 1921, No.6, 332.
It is stated that cultivation as practised in the United States is not known. Along the Magdalena River cotton is raised on plantations ranging in size from 25 to 150 hectares. Cotton seed is sown during April and May, and no other attention whatever is given to the crop until ready for picking. The variety of cotton grown bears four or five consecutive years without replanting. Estimates of production vary considerably, but it would seem that in the year 1920 about 3,000,000 lbs. of cotton lint were picked. —L. M. S.

French Flax Crop; Smaller——Expected. U.S. Commerce Reports, 1921, No.7, 405.
The information gained by the Nord Industrial as the result of a canvass of the flax crop in France is given. —L. M. S.

Field Crops Work at McNeill and South Mississippi Sub-stations. E. B. Ferris. Experiment Sta. Rec. (from Mississippi Sta. Bull., 1920, Nos. 188 and 194), 1921, **45**, 223.
Refers to spacing, variety, and manurial tests with cotton and other crops.—W. R.

Cotton in Texas. Experiment Sta. Rec. (from Texas Sta. Rept., 1919), 1921, **45**, 229.
Reports inheritance studies with cotton involving widely contrasted characters, such as green and red plant colours, white and coloured lint, long and short fibre. Studies have also been made of the inheritance of high and low oil content in cotton seed. —W. R.

Cotton Growing in S. Mississippi. E. B. Ferris. Experiment Sta. Rec. (from Mississippi Sta. Bull., 1920, No.196), 1921, **45**, 129.
Gives details regarding varieties, methods of cultivation, and fertilisers most useful in the production of cotton in Southern Mississippi. Trice cotton proved the best under average conditions. —W. R.

Hemp and Fibre Flax in Wisconsin. Experiment Sta. Rec. (from Wisconsin Sta. Bull., 1920, No.323), 1921, **45**, 228.
Describes experiments with hemp on marsh lands using Japanese seed.—W. R.

Flax Industry in West Australia. Text. Merc., 1921, **65**, 622.
In a report to the Minister for Agriculture on the prospects of the flax and linseed industry in West Australia, Mr. R. F. Strachan says that a considerable area in the south-west, east of the Albany Railway, is suitable in soil and climate for flax growing. Farmers here, as in the other States, would not, however, grow flax if they had to manufacture the fibre and clean the seed. Co-operative associations were needed to provide the plant. He was endeavouring to form an Australian association, with growers as material shareholders, to establish spinning and weaving mills capable ultimately of dealing with 10,000 acres of flax crop, and supplying Australia's requirements. —L. M. S.

Long-staple Cotton. H. F. Ashurst. Experiment Sta. Rec. (from Cong. Rec., 1921, **61**, 4471—4479), 1921, **45**, 534.
The production of cotton in the irrigated districts of the South-west in 1920 is described, with special reference to the Pecos, Rio Grande, Yuma, Imperial, Coachella, San Joaquin, and Salt River Valleys. The author treats in detail the agricultural and economic factors involved, including the development of the industry, types grown and areas cultivated, Pima Egyptian cotton, gins and ginning, labour conditions, cost of production, importance of increased yields, climatic difficulties, both shedding, cotton production and other crop industries, syndicated cotton production, relations of manufactures to cotton producers, seed supplies, and financing and marketing the crop. Approximately 255,000 acres of upland cotton and 240,000 acres of Pima Egyptian cotton were grown under irrigation in the South-western States in 1920.

Arkansas Cotton Diseases. J. A. Elliott. Experiment Sta. Rec. (from Arkansas Sta. Bull., 1921, No.173), 1921, **45**, 353.

Gives popular descriptions of a number of the more common diseases of cotton and control methods. In connection with the control of angular leaf spot (*B. malvacearum*) experiments in de-linting cotton seed with sulphuric acid are described. —W. R.

Yellow Leaf Disease in Phormium tenax. Experiment Sta. Rec. (from New Zealand Jl. Agric., 1919, **19**, 89-93), 1921, **45**, 353.

Yellow leaf is an infectious disease caused by attacks of fungi or bacteria. Stagnant water favours the disease; diseased plants may frequently recover completely; few plants die outright, and some plants appear to be immune to the disease. —W. R.

Germination of Seed of Phormium tenax. Experiment Sta. Rec. (from Scot. Jl. Agr., 1921, **4**, 79-80), 1921, **45**, 342.

The seed of *P. tenax* grown in Scotland is slow in germinating, and possibly does not retain the power of germination more than one year. The best method of testing the germinating capacity of this seed is described. —W. R.

Pink Boll-worm; Preliminary Note on Triphleps tantilus Motsch, an Enemy of the——. E. Ballard. Agric. Jl. India, 1921, **16**, 571-573.

It is known that this insect sucks the eggs of pink boll-worm in Egypt. In India (Coimbatore) it has been recently found, and it feeds there both on the eggs and on the freshly emerged larvæ of the pink boll-worm. It also feeds on cotton aphis and cotton thrips, and is obviously of importance as a possible means of control of pink boll-worm and these other pests. —W. R.

Cultural Experiments with Cotton. G. B. Walker and W. E. Ayres. Experiment Sta. Rec. (from Miss. Sta. Circ., 1921, No.35), 1921, **45**, 130.

Gives the results of spacing tests conducted at the Delta sub-station, together with information regarding the culture of cotton under the conditions of the delta. It was found that 12 inch spacing gave the best results in every series of tests. —W. R.

Cultivation of Long Staple Cotton in the South-Western Districts of U.S.A. Agric. Jl. India, 1921, **16**, 577-582.

Summarises a report by Mr. C. S. Schofield, of the U.S. Department of Agriculture, on the development of the industry in the irrigated lands of the S.W. of U.S.A. In concluding a number of important general principles are enunciated relating to the degree to which the cultivation can be made profitable, to the necessity for rotation with other crops in themselves profitable, and the local production of satisfactory seed for planting. —W. R.

Varieties of Cotton, 1919-20, and Summary of Ten Years' Results at the Mississippi Delta Station. W. E. Ayres. Experiment Sta. Rec. (from Mississippi Sta. Circ., 1921, No.36), 1921, **45**, 130.

Of all the varieties tested Express gave the best average yields over the period. —W. R.

Cotton Experiments, 1919-20, in Mississippi. H. B. Brown and C. B. Anders. Experiment Sta. Rec. (from Mississippi Sta. Bull., 1920, No. 187), 1921, **45**, 130.

Describes experimental trials carried out on similar lines to those previously reported. —W. R.

Uniformity of Length of Cotton Hairs. J. R. Hilson. Agric. Jl. India, 1921, **16**, 564-566.

Describes a new method of estimating the uniformity of length of lint, which also shows the range of variation and the proportion in which each length is present. The method applies Ball's maximum combed length method to Indian cottons, but only the lint on the right half of the seed is combed out, and the distance from the butt end of the median line to a point on the halo represented by three o'clock. In the samples tested the ranges of each were nearly equal in width, since the author has not yet found a type with a very narrow range of combed length. —W. R.

Cotton Boll-weevils. A. W. Morrill. Jl. Econ. Ent., 1921, **14**, 373-374.

A note on boll-weevils from wild and cultivated cottons on the W. Coast of Mexico. Typical *grandis* and *thurberiæ* varieties were found, as well as a number of apparent hybrids. —W. R.

Cotton Growing in Nigeria. See *Jl.*, 1921, **12**, 468.

(D)—ARTIFICIAL.

Artificial Silk; Success with a New——. Amer. Silk Jl., 1921, **40**, 62.

A new fibre yarn made in Germany has been put on the market as "Bemberg" and "Eagle." It consists of the same fine cocoon ends as worm silks, and is said to have the softness, flexibility, and lustre of silk, and to be durable, washable, and strong in the wet state. It is obtainable in 180, 120, and 80 denier sizes. It is suitable for silk or cotton mixtures for sheets, ties, linings, damasks, crêpes, and satins. —F. G. P.

Fibre Silk Plant Running. Women's Wear, N.Y., 1921, **23**, 6.

A factory in Cleveland is said to be producing fibre as low as 80 deniers. It is believed that the use of this material will eventually exceed that of silk, as, being machine-made, it will probably get cheaper. The use of artificial fibre in mixtures with cotton and wool is increasing. —F. G. P.

Artificial Silk in America. Chem. Trade Jl., 1921, **69**, 694.

The modifications and new products possible for the manufacturer of artificial silk are outlined. By increasing the size of the aperture through which the cellulose solution is forced, artificial hair may be produced of value in the manufacture of upholstery materials, etc.; by changing the shape of the aperture to a horizontal slit, artificial straw may be made; or, by further widening the slit, strips of artificial leather or cloth, films, ribbons, etc., are produced. A method has been devised in which net and simple forms of lace are produced in one operation, by passing the solution into engraved lines on a revolving cylinder from which the finished product is continuously peeled as it issues from the fixing bath. —L. M. S.

German Artificial Fibre. Women's Wear, N.Y., 1921, **23**, 14.

A German explosive factory has patented a process for an artificial fibre called "Vistra," which is said to closely resemble silk. It can be spun into yarn for all purposes, and the output is claimed to be unlimited. Other explosive factories are stated to have begun making the fibre. —F. G. P.

New Silk-like Fabric being made in Utica. See Section 3G.

Czech Artificial Silk Factory in Operation. See Section 9.

Cellulose-acetate and Viscose Silks; Notes on——. See Section 6.

PATENTS.

Obtaining Fibres from Vegetable Material. Soc. Parisienne d'Etudes Industrielles et Financieres, Paris. E.P. 169,998. (Appl. No. 26,480/21.) Conv. Oct. 11, 1920.

The fibre-extracting machine comprises a driving roll and a drum provided on its periphery with grooves extending throughout the length of the drum. The material is arranged parallel on a feed table and fed between the driving roll and the drum to a laterally reciprocating work table consisting of a rigid cage in the shape of an inverted U in which is a rubber band acting as a backing to shoes, the working faces of which are grooved similarly to the drum. The drum is driven at a variable speed by gearing operated by a worm, and is, by variable gear, also automatically reciprocated towards and away from a work-table. A roll leads the treated strips out of the machine on to a conveyor. The shape and dimensions of the grooves on the drum and work-table may be varied according to the material to be treated. —T. W.

Packing Cotton, etc. J. H. Hindle and T. Hindle, Haslingden, Lancashire. E.P. 169,469, Sept. 27, 1921. (Appl. Nos. 8,990 and 36,137/20.)

Cotton, wool, jute, &c., is compressed into containers *a*, held in a casing *a'*, by plungers *b*, *c* moving simultaneously from opposite directions. The ends *e* of the containers, comprising dished metal discs flanged at *f*, are carried into position by the plungers and are welded or spun to the container before the plungers withdraw, the sides of the casing *a'* being hinged. —T. W.

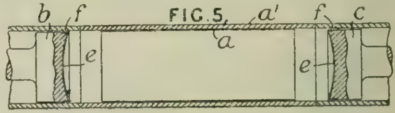


FIG. 5

Treating Retted Flax. C. P. Turner, Brixton. E.P. 169,407, Sept. 29, 1921. (Appl. No. 35,076/20.)

Retted flax and the like in bundles is placed in a centrifugal separator to remove the moisture. Water is then sprayed on to the bundles from central pipes and the gums washed away. Hot air is now delivered into the centre of the separator through a conduit pipe to dry the material. The spindle of the separator is mounted in ball bearings and rollers mounted in a casing surrounding the separator support the upper portion of the rotating part. Moisture expelled from the material is drained off through a cock, and the hot air which is passed in through a conduit and hood is drawn off through a pipe. Baffles guard the entrance to this pipe and prevent the escape of moisture from it. The water pipe may be lifted out from the separator, while the water and hot air may be introduced from the bottom through a hollow spindle. —T. W.

Corn and Cotton Chopper. James C. Smith, Havana, Ark. U.S.P. 1,390,173, Sept. 6, 1921. Appl. 26/2/20. (3 claims: 2 printed.)

The machine comprises a main frame having ground wheels, and a chopper frame disposed in trailing position with reference to the main frame, the chopper frame comprising spaced side bars each universally connected at its forward end to the rear of the main frame, transverse forward and rear bars spanning the side bars of the chopper frame and pivotally connected to the latter, a chopper wheel, a chopper shaft rotatably mounted in bearings in the said side bars and composed of sections by means of which it becomes extensible, means for communicating motion from the ground wheels to the said shaft, and handles carried by the rear transverse bar of the chopper frame, whereby lateral movement may be imparted to the latter for purposes specified. T. W.

Preparing Fibres for Spinning: Breaking and Scutching Apparatus. E.P.169,999. (Appl. No. 26,481/21.) Conv. Oct. 11, 1920.

Fibrous stalks are fed from a hopper to a pair of longitudinally grooved rollers, the lower one being spring supported. They then pass between a smooth roller and a corresponding block which is reciprocated vertically by eccentrics to hammer the material against the roller. The stalks are finally treated by bars carried by rotating spiders and are delivered on to a conveyor. The edges of the grooves on the rollers, of the block, and of the bars are rounded. The feed hopper is pivoted and its inclination can be adjusted by means of curved arms with notches adapted to engage a bar. The rotating parts are driven positively by chain and spur gearing from the main shaft. —T. W.

Fibre Extracting Machine. William Oren Lambert and George Herbert Pound, El Paso, Tex. U.S.P.1,389,883, Sept. 6, 1921. Appl. 18/3/20. (26 claims: 2 printed.)

The machine comprises reversely-driven aligned shredding members, a feeder at one side of the shredding members adapted to grip the butts of the articles and move the latter through the machine and from one end to the other of the shredding members, and cutting means disposed adjacent the inner side of the feeder to sever the shredded body of the article from the butt. —T. W.

Cotton chopper. John Leslie Doss, Albany, Ala. U.S.P.1,390,100, Sept. 6, 1921. Appl. 13/12/20. (1 claim: 1 printed.)

An agricultural apparatus comprises a tongue, a channel frame bar having its channel innermost and also having forward parallel terminal portions between which the tongue is received and secured, rearwardly divergent forward portions, side portions, inner loops at the rear ends of the side portions and a traverse portion interposed between and joining the inner ends of the loops, a traverse bar interposed between and fixed to the side portions of the frame bar a shaft-journalled in the side portion of the said frame bar and having ground wheels exterior of the frame and also having a mitre gear, a longitudinal shaft having a mitre gear intermeshed with said mitre gear of the transverse shaft and also having a clutch member and an additional longitudinal shaft journalled in the said interposed rear portion of the frame bar and having a complementary clutch member, yielding means on the last-mentioned shaft to retain the clutch member thereon in engagement with the first-named clutch member and means to adjust the third shaft rearwardly and adjustably fix the same. —T. W.

Cotton Blocking Machine. Barnie S. Ford, Coleman, Tex. U.S.P.1,390,114, Sept. 6, 1921. Appl. 19/10/20. (1 claim: 1 printed.)

Means for converting a cultivator into a cotton checking machine consists of combination with the cultivator of spaced clamps on the beams thereof, each clamp including two mating sections depressed at the confronting ends thereof to receive the cultivator beams, adjustable securing means for the sections, auxiliary beams supported at the outer ends of the clamp sections, binding means between the clamp sections and said auxiliary beams, and a sweep plough having its shaft adjustably secured on each of the last-mentioned clamps. —T. W.

Preparing Fibres for Spinning: Breaking Apparatus. T. E. Mitchell, Blairgowrie, and W. Dixon, Glasgow. E.P.169,293, Sept. 26, 1921. (Appl. No. 17,287/20.)

The minimum clearance between the intermeshing teeth of the rollers of breaking machines is from 40 to 80% of the thickness of the flax straw in the rough after passing between plain rollers, there being at least fifteen teeth round the periphery of the roller. The width of the teeth lies between 0·25 and 0·35 of the pitch of the teeth taken at their tips, and the amount of the intermesh of the teeth lies between the width increased or decreased by 25%. The teeth are supported by end spiders slotted to receive the teeth, and are locked in position by rings secured by screws. Intermediate spiders support the teeth. The clearance can be trued by passing strips faced with abrasive and of the requisite thickness between the rollers. —T. W.

Fibrous Plant Decorticating Machine. Frank O'Neill, Jnr., Philadelphia, Pa. U.S.P.1,390,922, Sept. 13, 1921. Appl. 22/11/17. (6 claims: 5 printed.)

The machine consists of an endless series of travelling rolls arranged in pairs, a frame supporting a pair of said rolls, one of the rolls of a pair being loosely mounted in said frame so that it may bodily change its position, and a guide controlling said loosely mounted roll. —T. W.

Cotton Packer. French B. Williams, Dallas, Tex. U.S.P.1,392,097, Sept. 27, 1921. Appl. 11/5/20. (1 claim: 1 printed.)

The apparatus has a reciprocating member, a continuous rack on said member composed of parallel side portions and curved end portions connecting the side portions, a drive shaft, a pinion thereon engaging the rack, a guide bar carried by the reciprocating member, and a roller carried by the shaft and engaging said bar for holding the pinion in engagement with the rack at all times, and a horizontally movable carriage supporting the pinion end of the shaft and a track for said carriage. —T. W.

Artificial Silk; Manufacture of——. E. Bronnert. U.S.P.1,393,197 — 1,393,199, Oct. 11, 1921.

Threads of viscose are coagulated in a solution of a salt and an acid, the proportion of the latter varying inversely to the square root of the size of the thread. Viscose is squirted into an acid coagulating bath, the concentration of which is increased proportionately with the increased fineness of the thread required, and the increased viscosity of the viscose. —F. G. P.

Cotton Chopper. Benjamin P. Collier, Albany, Ala. U.S.P.1,391,246, Sept. 20, 1921. Appl. 13/10/20. (5 claims: 1 printed.)

The machine consists of a main frame, a ground wheel journalled thereon, a loop-shaped bracket, a pivot element uniting the bracket with the main frame for swinging movement on a vertical axis, an auxiliary frame including side members and a bearing carried thereby, a pivot element uniting the side members with the bracket to permit a vertical swinging movement of the auxiliary frame with respect to the bracket, a shaft including parts, one of which is journalled on the main frame and the other journalled in the bearing, a universal joint connecting said parts of the shaft and located within the bracket, an operative connection between the first specified one of said parts of the shaft and the ground wheel, and a rotary hoe carried by the other of said parts of the shaft. —T. W.

Artificial Threads from Viscose. N. Jentgen. G.P.340,289, Nov. 16, 1920. Jl. Soc. Chem. Ind., 1921, **40,** 808A.

Viscose is spun into a water extract of fir twigs and bark to which an acid or acid salt is added. It is claimed that pale shades can be dyed on the product, which has high elasticity and tensile strength. —F. G. P.

Apparatus for Flax Swinging. Lesage. F.P.514,060. Appl. 17/4/20.

The aim of this apparatus is (1) to suppress the locking and unlocking of the presses containing flax stricks, to suppress these presses, and to present automatically the flax stricks to rotating swinging cylinders in pressing these stricks through ropes in groove wheels; (2) to effect automatically the shifting of the flax strick in order that the unwrought part passes, at its turns, in other rotating cylinders which terminate the swinging. An increase of production and a diminution of labour result from this arrangement. —Bur. Text.

2.—CONVERSION OF FIBRES INTO FINISHED YARNS.

(A)—Preparatory Processes.

Raw Silk Cleaner. Silk, N.Y., 1921, **14,** 84.

A device for removing defects on silk preparatory to throwing. The fibre passes through a guider, then through a fine slot in a steel plate which removes knots, slubs, etc., and thence through a second guider. The steel plates are in three sizes, and have a hole at the rear of the slot to permit the removal of dirt, gum, floss, etc., and so avoid the breakage of the thread. No adjustment other than putting in the appropriate slot for the size of silk is required. —F. G. P.

Perham and Davis Evener; Mechanics and Practical Operation of the——. S. A. Ford. Cotton, U.S.A., 1921, **85,** 878-81.

The Perham and Davis evener and its practical operation is described. In a comparative test, the variations in lap weight per yard without the evener were 12·4% on the intermediate and 7·2% on the finisher, but only 7·6% and 2·4% respectively with the evener in operation. —L. M. S.

(B)—Spinning and Doubling.

Spinning of Hosiery Yarns. Rev. Text., 1921, **19,** 1311.

The self-acting mule is more suitable for spinning hosiery yarns than is ring spinning. However, machine designers have made much progress in adapting the ring frame to give the full yarns suitable for hosiery. —W. D.

Band Tying Gauge; A New——. Cotton, U.S.A., 1921, **85,** 933-935.

An automatic device is described by means of which individual spindle bands can be adjusted to a tension of 2lbs. —L. M. S.

Automatic Hank Reel. W. Meister. Textilberichte, 1921, **2,** 355.

A new automatic hank reel is described and illustrated. —L. M. S.

Accident Precautions. See *Jl.*, 1921, **12,** 468.

(D)—Yarns and Cords.

Yarn from Typha Fibres. Deuts. Faserstoffe (from Dtsch. Leinen-Industrieller, 1921, No.12, 185), 1921, **3,** 115.

Attention is drawn to the complaint made against typha fibre—that it has proved too brittle and hard to prepare useful yarns from it. It is stated that good yarn up to Nos. 6 and 7 has been prepared from typha fibre since 1904. —L. M. S.

Breaking Strength of Yarns; Decrease in——. Cotton, U.S.A., 1921, **85,** 901-902.

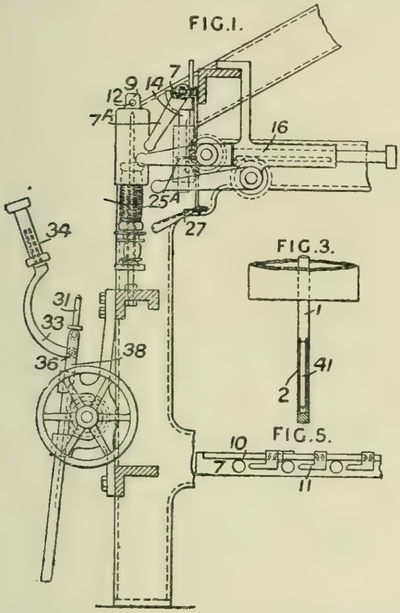
At a meeting of the Southern Textile Association it was announced that a general decrease in yarn breaking strength had occurred throughout the section, and it was attributed by some to the dry weather. One member stated that he had overcome the difficulty by running slacker tension on the fly frames. —L. M. S.

Diameter of Yarns. See *Jl.*, 1921, **12,** 469.

PATENTS.

Spinning: Doffing Arrangements; Spindle Apparatus. W. Feather, Bingley, Yorkshire. E.P.170,038, Oct. 3, 1921. (Appl. No. 14,853/20.)

The spindles of cap frames are made in detachable parts 1, 2, Fig. 3, and the upper parts and the caps are raised and tilted by a " grabber " so that the full bobbins may drop on to pegs 31 and the empty bobbins may be placed on the part 1 from hollow pegs 34. The " grabber " comprises a perforated bar 7, which passes over the head of the caps and a slidable bar 10, Fig. 5, provided with projections 11 adapted to engage holes 12, and is tilted by a handle 7A in bearings in a vertical rack bar 14 mounted in a bracket on a horizontal rack bar 16. A bracket attached to the " grabber " carries projections 27 which support the full and empty bobbins. The empty bobbin pegs 34 are movable about the pivot 36 of arms 33 and, with the full bobbin pegs 31, are raised and lowered by inclined rack bars 38. A nipple 41 on the upper part of the spindle enters the hollow pegs 34 when the empty bobbins are being placed on the spindles. Plates 25A engage the caps and support them when in the tilted positions.—T. W.



Spinning: Mules. W. Burton, Lockwood, near Huddersfield. E.P.169,230, Sept. 16, 1921. (Appl. No. 16,238/20.)

In a device of the kind described in Spec. 792/88, for regulating the length of yarn delivered by the rollers, the adjusting shoe which controls the rotation of the length wheel is operated by a slide moved by the shaper shoe, an upright lever, and an upper slide carrying the shoe. A spring on the bottom slide is provided to cause the parts to follow the return movement of the shaper shoe. —T. W.

Spinning: Mules. G. Wilson, Birstall, near Leeds. E.P.169,588, Oct. 6, 1921. (Appl. No. 23,127/20.)

The quadrant chain is prevented from moving during doffing by a catch adapted to engage the chain. The catch is pivotally mounted on an adjustable bracket, and can be turned over to rest on a stop when out of action. The pivot of the catch can slide in a slot in the bracket against the action of a spring. —T. W.

Spools, etc. G. H. Hickin, Leicester. E.P.169,551, Oct. 6, 1921. (Appl. No. 20,464/20.)

Spools and the like of the type used in knitting mills have their barrel portions and bases reinforced with shells or coverings of tin or other non-fibrous material which will dent rather than fracture when subjected to a blow. Spec. 4,215/00 is referred to. —T. W.

Artificial Silk, etc. L. A. Levy, London. E.P.168,986, Sept. 12, 1921. (Appl. No. 15,780/20.)

To recover the volatilized solvent, etc., in the production of artificial silk and the like the air charged with the solvent passing from the chamber enclosing the spinning apparatus is, according to Spec. 137,615, brought into contact with highly activated absorbent charcoal in an adjoining chamber, and the volatile solvent is afterwards recovered by a process comprising the earlier invention or by treatment with steam or carbon dioxide at a suitable temperature. A series of successive chambers may be employed if desired. —T. W.

Clearing Yarns. J. O. McKean, Westfield, Massachusetts, U.S.A. E.P.169,160. (Appl. No. 23,812/21.) Conv. Sept. 16, 1920.

A slub catcher or yarn clearer comprises a resilient yoke, the branches of which are provided with lateral extensions forming a slit through which the yarn passes, and means, by an adjusting screw, to alter the position of one of the branches to vary the width of the slit without disturbing the parallelism. A pin projects from the upper extension and serves as a guide for the yarn, while the upper branch carries a tension device comprising a weighted disc loosely mounted on a pin and a table co-operating therewith. A guard is provided for the pin. —T. W.

Treating Cords, Threads, etc. S. W. Wardwell, Providence, R.I., U.S.A. E.P. 169,223, Sept. 12, 1921. (Appl. No. 15,849/20.)

The product of a braiding machine, or of a spinning, twisting, or like apparatus is passed through a tank of liquid, such as size when used for sewing threads, or rubber solution, etc., when used for tyre fabric threads, then through a pair of squeezing rollers, and finally dried while passing over another pair of rollers. Spec. 12,993/88 and 2,437/11 are referred to. —T. W.

Preparing Fibres for Spinning: Openers, etc. J. Bancroft and Howard and Bullough, Accrington. E.P.170,130, Oct. 20, 1921. (Appl. No. 22,032/20.)

The fans for the dust cages of individual openers and cleaners are discarded, and dust cages are connected by curved ducts to a common duct provided with a single fan which discharges the dust from a number of machines into a dust chamber. The central duct may be under the floor, and the fan also on the floor but in a separate room. The suction may be regulated by wing valves in the side flues and operated from outside the machine. The central ducts of several lines of machines may be connected to a larger duct provided with a single fan. If all the machines do not work in combination, more than one fan may be employed to allow for convenience in working.—T. W.

Spinning: Spindle-driving Apparatus; Spindle Apparatus. Haubold Akt.-Ges., C.G. Chemnitz, Germany. E.P.170,285. (Appl. No. 26,785/21.) Conv. Oct. 15, 1920.

Cups for spinning artificial silk are mounted on spindles driven by water power or turbines enclosed in a casing. The casing encloses all the turbines of a group of cups. A common outlet is provided, but each drive has a separate supply nozzle. Partitions are arranged between each turbine, and the casing is acid tight. —T. W.

Twisting Machine. William Scholes, Philadelphia, Pa. U.S.P.1,391,512, Sept. 20, 1921. Appl. 8/11/16. (3 claims: 1 printed.)

A machine for forming flat ribbon into twine comprises stationary crushing eyelets, and means including a rotary winding spindle for drawing the ribbon from a supply roll with a twist and through the eyelets against their crushing resistance, so as to wind it in the form of compact twine. —T. W.

Thread Guide for Ball Winders. Harold A. Denmire, Akron, Ohio, Assr. to The Goodrich Co., New York. U.S.P. 1,391,247, Sept. 20, 1921. Appl. 21/11/18. (4 claims: 1 printed.)

A machine for winding elastic rubber thread into a ball comprises a holder having means for turning the ball on different axes to give a spherical winding, a rotary wing winder carrying an elongated thread spool, a guide roller on said winder mounted to rotate on an axis transverse to the axis of the spool, and so positioned as to remove the thread from the said spool approximately at right angles to the axis of said guide roller, but from various directions, and turn its course in a substantially fixed direction through less than a complete turn, and means on said winder for guiding the thread from said roller on to the ball. —T. W.

Apparatus for Spinning, Doubling, and Twisting Yarns or Threads of Fibrous Substances. Thomas Whitehead, Blackpool. U.S.P.1,389,921, Sept. 6, 1921. Appl. 17/2/19. (5 claims: 1 printed.)

The mechanism consists of a spindle with means for rotating it, an independently driven ring carrier constituting a bearing for the spindle, and a self-adjusting bearing for the carrier. —T. W.

Silk Throwing Machine. Paul Hyde Bonner, New York, N.Y., Assr. to Stehli Silks Corporation. U.S.P. 1,390,081, Sept. 6, 1921. Appl. 31/7/20. (5 claims: 1 printed.)

A silk throwing machine comprises twisting means for twisting at least two silk ends together to form a low twist thread, take-up rollers for taking up and imparting a travelling motion to the threads, means for operating the rollers at considerably less speed than that of the twisting means, twisting and winding means receiving the thread from the take-up rollers and twisting it to form a high twist thread and winding it on to a spool, and means for operating the twisting and winding means at considerably greater speed than the low twisting means. —T. W.

Yarn Cleaning Device. William E. Goyette, Philadelphia, Pa., Assr. to John E. Garey, Elmira Heights, N.Y., U.S.P. 1,391,540, Sept. 20, 1921. Appl. 26/6/17. (35 claims: 1 printed.)

The device has, in combination, a moving yarn-cleaning element, and means for moving said element actuated by the yarn. —T. W.

Method for Producing Rovings from Paper Pulp. Friedrich Paul Prein, Heldenheim-on-the-Brenz, Germany, Assr. to Turk. Gesellschaft m.b.H. U.S.P.1,392,282, Sept. 27, 1921. Appl. 26/3/18. (3 claims: 1 printed.)

The machine comprises means for forming and conveying strips of wet paper stock, a distributing drum of large diameter and a plurality of rubbing devices to roll said strips into rovings, the drum presenting a circumference large enough to maintain said rubbing devices sufficiently for access between them of workmen. —T. W.

Fixing Various Rings in Ring-spinning Frames. Ateliers de Construction de Bitschwiller. F.P.514,118. Appl. 20/4/20.

This patent refers to an arrangement for fixing rings when it is necessary to change rings on spinning or doubling frames. A split supporting collar is mounted on the ring to be fixed; this collar possesses, at its exterior part, a circular groove in which is the bed of an extensible metallic loop or of another elastic body. The fixing is assured by the elastic action of the loop or of the ring compressed between the supporting collar and the circular edge of the organ on which the ring has to be mounted. —Bur. Text.

Automatic Changing of Spindle Cord in Spinning Frame. Meegens. F.P.514,449. Appl. 2/4/20.
The following arrangement allows a spindle cord broken during working to be automatically changed. An iron square is fixed to the frame. On the same is a slide-bar which supports the spindle cord and conducts this cord from behind the cylinder. This cord is attached to a counter-weight, and it is taken again before the cylinder and knotted. —Bur. Text.

Spinning Ring. James K. Lanning, Fall River, Mass. U.S.P.1,392,067, Sept. 27, 1921. Appl. 28/10/15. (14 claims: 9 printed.)
A spinning ring provided with a traveller flange, the upper surface of which is concaved and is provided with an annular ridge spaced from the edges of the ring. —T. W.

Reel for Skeins of Yarns. R. Caillon. F.P.514,400. Appl. 14/4/20.
This apparatus is patented for increasing the speed of reeling and to permit a quick starting of the yarn. The arrangement consists of a reeling arm, having a very low weight and a certain elasticity. It is provided with an axle, loosely mounted on the reel. This arm is bent in order that its free end, which supports an eyelet or a ring for passing the yarn, is placed in the same plane as the reel. This arm is also braked by a spring. It is carried away by the yarn which reels, and it obeys the various speeds of reeling. —Bur. Text.

3.—CONVERSION OF YARNS INTO FABRICS.

(C)—WEAVING.

Ribbon Weaving. Rev. Text., 1921, 19, 1305.
In ribbon weaving it is of considerable importance to determine when the weaving should be done by inserting the weft in the closed or the open shed as widely different results in texture may be thereby obtained. When beating-up the closed shed the warp threads cross before the beating-up of the weft, and in this way the weft yarns encompass the thread of warp and become more prominent. In the open shed, the beating-up takes place before the shed changes, and the weft therefore remains perfectly straight. In cases of heavy shotting, the shed should be slightly open when the weft is beaten up. The same shed should not be employed for all fabrics, but it should be modified according to the weave and the character of the warps and wefts. —W. D.

Beaming Coloured Cotton Goods. H. D. Martin, Text. Colorist, 1921, **43**, 750-752.
A general account of the beaming of coloured cotton goods. —L. M. S.

Analysis of Weaving Designs. See Section 8.

(D)—KNITTING.[1]

Knitting Needle; An Improved——. Textiles, 1921, **19**, 35.
The drawback of the present style of latch needle is that in the fine gauges the dimensions of the latch and the rivet are so infinitesimal that considerable difficulty is experienced in obtaining needles with the necessary strength of working parts to sustain the strains of knitting action. An attempt has been made to introduce a means of knitting whereby these weaknesses may be obviated. A composite needle of two elements is used, one provided with a hook to take the new loop of yarn and the other being a slide provided with a hook to take the loop from the drawing hook. These drawing and casting parts of the needle are of the same width to fit the needle grooves of the cylinder and to slide on each other. —W. D.

(G)—FABRICS.

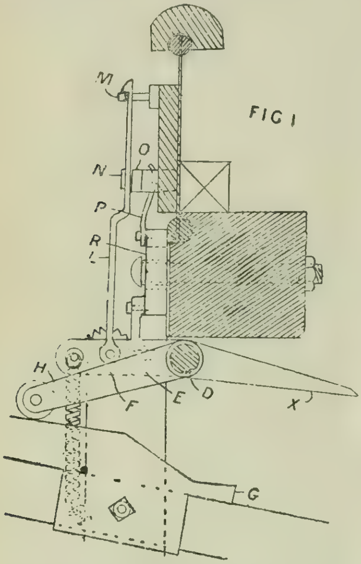
Paper Fabrics. J. Huart. L'Ingénieur Text., 1921, **19**, 784.
The manufacture of textilose at Malines is described. Two kinds of yarns are produced—paper yarn usually known as xylolin, which is not very supple, and textilose, which is much more supple. In the manufacture of the latter, a cotton nap is detached from a card and deposited on the face of the sized paper in order to make the yarn more supple. Details for the weaving of different fabrics from these yarns are given. —L. M. S.

New Silk-like Fabric being made in Utica. Women's Wear, N.Y., 1921, **23**, 6.
A fabric called Firscheen which looks and feels like silk is now on the market. It is made from Norwegian spruce, and is used for underclothes, dresses, sweaters, etc. The material is reversible; ordinary knitting machines may be altered to work it. —F. G. P.

Fancy Heavy-weight Woollen Overcoatings. Text. World Jl., 1921, **60**, 85.
Re-worked wool is specially suitable in these fabrics because the strain on them is generally less severe than on suitings. The styles in great demand in the American market are all produced with a light shade of warp and a dark shade of weft yarn, the warp yarns being made from 45% three-quarter-blood wool noil, 10% three-eighths-blood wool noil in nubs and 45% B super wool. In the weft, 40% of the weight is B super wool, and 60% picked yarn waste equivalent in quality. The nubby feature is very valuable, and all the white wool should be a good pure shade. To preserve the nubby feature, the material should not be so much opened out in carding as is usual, and uniformity in the different stocks is essential. In burling, it is best to cut the tails from knots and let them go. —W. D.

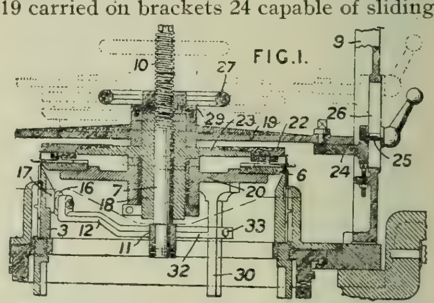
PATENTS.

Looms: Loose-reed Motions. J. Hummer, Newton Heath, Manchester. E.P.169,659, Oct. 6, 1921. (Appl. No. 3,208/21.)
A rising and falling bar R is pivoted to levers E on the stop-rod equivalent D, the levers E being normally held up against spring action, to make the reed fast, by levers F carrying hooked feeler rods L adapted to engage the knife M on the lay sword, but liberated from the knife when the shuttle, on failing to box properly, does not move the swell O outwardly against the feeler rods L. If the swell has not been moved outwardly the rollers on cam levers H on the rod D are free to keep in touch with the inclined surface of the runners G and thus allow the rod D to turn and to lower the bar R, in which case the reed is loose. The usual finger X knocks off the loom. The bar R is carried by brackets slidable in bearings in the lay swords, or it may be guided by brackets secured to the lay bottom. The levers H and the rod L may be adjustable lengthways. Springs N are provided to keep the rods L in contact with the swell, or the rods may have hooked portions engaging the swell. The bar R has springs P for acting against the shuttle box back. —T. W.



Looms: Checking Pickers. H. Foulds, Nelson. E.P.169,631, Oct. 6, 1921. (Appl. No. 28,920/20.)
A picking buffer holder with inturned ends has a flange around its bottom edge to support a number of leather pieces or other cushioning device. A spring may be inserted between the leather pieces and the holder. A hole is made through the holder and leathers for the spindle, and the holder is fastened to the spindle stud by means of a lug. —T. W.

Knitting Machines. M. Bromley and Co., Ltd., T. C. Bromley, and W. Cavers, Leicester. E.P.170,201, Oct. 20, 1921. (Appl. No. 30,038/20.)
The dial 6 and associated parts are movable vertically on a central spindle 7, and the drive is transmitted by a vertical rod 30 depending from a hub 20 carrying the dial 6 and rotatable on the spindle 7. The rod 30 works between adjustable stops 33 in an aperture of an arm 32 on a rotatable spider 11, the arms 12 of which carry eccentric studs with adjustable rollers 16, which engage dogs 17 projecting from the inner face of the cylinder 3. The dial cap 22 is attached to a flange 23 of a sleeve 18 which is secured to a transverse support 19 carried on brackets 24 capable of sliding vertically within slots 26 of fixed uprights 9. By turning a hand-wheel 27 working on the screwed part 10 of the fixed spindle 7 and having a circumferential groove engaged by a plate 29 fastened to the support 19, the dial 6 and associated parts may be raised to the position shown in dotted lines, the rod 30 sliding through the arm 32 without impairing the circumferential adjustment. The dial, etc., can be held in the raised position by clamping screws 25 at the commencement of knitting, and may be lowered when all the cylinder needles have loops and good fabric is being made. —T. W.



Darning. J. W. Pogson, Glasgow. E.P. 168,817, Sept. 15, 1921. (Appl. No. 2,476/21.)
A latch-needle is fitted with a handle, and is used to loop together the cross threads of a "ladder" in knitted fabrics. The needle is provided with a removable damp-proof cover. —T. W.

Looms: Shuttles; Changing Bobbins in—Automatically. Cohen and Schaefer, Fabrique pour Appareils de Tissage Lachen, Lachen, Switzerland. E.P. 169,153. (Appl. 22,156/21.) Conv. Sept. 13, 1920.
The transfer of the bobbin occurs before the lay reaches its front dead centre, the bobbin magazine swinging about a fixed pivot, and the transferring hammer swinging about a pin on the long arm of the transferring lever as the lay moves forward to the front dead centre. Suitable mechanism is employed to effect the changes at the points mentioned.—T. W.

Looms: Change-box Motions. T. Thompson and A. Ogden, both of Colne. E.P.168,934, Sept. 15, 1921. (Appl. No. 10,478/20.)

To minimise the number of blank box cards in weaving long checked patterns, such as sarongs, papoons, shawls, etc., the box mechanism is provided with a third cylinder or barrel for the purpose of carrying all or nearly all of the blank cards. Two barrels are loose and one fixed on the same shaft, one of the loose barrels—that carrying the blank cards—being normally stationary, while the other two barrels are rotated by their pawls. An extension on a card of the fixed cylinder lifts a lever on a second shaft, in which case the two cylinders are stopped and the third one brought into work and rotated until an extended card on this barrel raises an arm which results in the stoppage of the third barrel and the restarting of the other two. —T. W.

Looms: Shedding Motions. E. J. Entwisle, Preston. E.P.169,099, Sept. 22, 1921. (Appl. No. 26,777/20.)

Relates to a method of operating the positively-operated tappet lever for the pile warp of coir fabrics so that it may be brought into and out of action automatically while weaving the body and plain end portions of rugs or mats. The lengths of the mats can be regulated by the use of chain and sprocket wheels working in conjunction with the pile harness or shafts. —T. W.

Looms: Hand-power Looms; Shedding Motions. H. Gaara, Bö, Telemarken, Norway. E.P.169,166. (Appl. No. 24,336/21.) Conv. Sept. 15, 1920.

The shuttle-driving and heald-actuating devices are operated by mechanism comprising two pawls carried by levers connected by links to the reed frame and actuating a ratchet wheel on a shaft extending across the loom. Curved discs at each end of the shaft, provided with two projections, actuate spring-controlled levers connected by ropes to the picking members. The shaft also carries arms provided with rollers connected to the healds. The reed is worked by hand. —T. W.

Warp Beams. O. Eilhauer, Neustadt-on-Orla, Germany. E.P.169,603, Oct. 6, 1921. (Appl. No. 24,173/20.)

A loom warp beam has a screw thread along its surface on to which rings for laterally supporting superposed coils of warp are screwed to any desired spacing. The beam has a screw thread of pitch about equal to the rings, which are slightly tapered towards their rims. Passages are formed in the rings near their bases, through which are threaded S-shaped bands, to lie between the warps and the beam and rings to prevent the warp from catching. The beam has three grooves, and each ring has corresponding keyways to lock the rings. The keyways are so spaced in relation to the grooves as to give a wide range of adjustment. —T. W.

Tufted Fabrics. M. E. Southern, Perth, W. Australia. E.P.169,318, Sept. 29, 1921. (Appl. No. 19,312/20.)

Tufts of wool or goats' hair are knotted at their shorn ends and threaded into an open fabric to form fleece wool articles. The tufts are secured by stitching, and the knotted ends may be crocheted into a piece of crochet work which forms an integral backing for the tufts. The tufts may be dyed and combed after attachment to the foundation to give the appearance of unshorn wool on its natural skin. —T. W.

Compound Fabrics. T. Sloper, Devizes, Wiltshire. E.P.169,524, Sept. 26, 1921. (Appl. No. 17,600/20.)

Relates to the manufacture of rubber goods in which one or more layers are mechanically contracted before or during the shaping of the article. —T. W.

Winding Yarns. F. Mansfield, Long Eaton, Derbyshire. E.P.169,530, Sept. 30, 1921. (Appl. No. 17,834/20.)

The bobbins on slip winding machines are driven by a split stud or crank pin on the bobbin spindle, and are preferably fitted with a metal end plate. The driving pulley of the bobbin, which is driven frictionally by a larger pulley, may be provided with an india-rubber or like surface. —T. W.

Looms: Pickers. Wood-Milne, Ltd., and T. Waring, D. Ashton, and E. R. Pearce, Leyland, Lancashire. E.P. 169,560, Oct. 6, 1921. Appl. No. 21,495/20.)

A loom picker comprises a body constructed of a number of layers of rubber canvas folded around a lug portion which is itself constructed of layers of rubber canvas. The complete picker is impregnated and covered with rubber in solution and converted into an integral block by curing. The impact faces and parts sliding on the picker spindle may be faced with vulcanite or other hard rubber. —T. W.

Weavers' Shuttle Threaders. S. Hartley, Yorkshire. E.P.169,600, Oct. 6, 1921. (Appl. No. 24,118/20.)

Relates to a suction device operated by a treadle for threading the weft in shuttles. —T. W.

Braiding Machine. Arlon Littlefield, Cranston, R.I., ,Assr. to New England Butt Co. U.S.P.1,389,672, Sept. 6, 1921. Appl. 15/1/20. (7 claims: 1 printed.)

A braiding machine comprises a body portion including the braiding and twisting elements, a frame consisting of two side standards and supported on the body, a mechanism supporting cross-bar removably mounted on the standards, a rear standard on the body portion of the machine and positioned between the side standards, and means whereby the rear standard is caused to co-operate with the cross-bar for adjustably supporting the mechanism. —T. W.

Knitting Machines. Soc. des Etablissements Lebocey frères, Troyes, France. E.P.169,690. (Appl. No. 21,962/21.) Conv. Sept. 28, 1920.

The needle bar instead of being mounted directly on the operating lever is mounted on or is integral with brackets pivoting on axles of a lever and held in normal working by two bolts engaging the said lever. When one of the bolts is slackened, the needle bar can be brought forward to enable needles to be straightened, etc. —T. W.

Looms: Toothed Gearing. D. C. Leonard, Greenville, South Carolina, U.S.A. E.P.169,905, Oct. 13, 1921. (Appl. No. 27,483/20.)

A motor shaft is coupled directly to a cross shaft provided with a worm which drives a worm wheel on a shaft parallel to the main shafts and is provided with a sprocket wheel from which a chain drives a similar sprocket wheel on the crank shaft of the loom. The shaft, which is parallel to the main shafts, may be arranged to carry two sprocket wheels for two adjoining looms. The cross shaft fits through threaded bearing sleeves which can be adjusted in the ends of a gearing casing by means of socketed heads to take up wear in the worm gearing, while collars constitute a thrust bearing. An electric motor, which may be controlled by a switch of the oil type, is used. —T. W.

Rugs: Weaving. M. Feldman, New York. E.P.170,090, Oct. 10, 1921. (Appl. No. 20,329/20.)

Grass or straw strands are interwoven with cotton or other warp threads, with cotton, woollen, or other strips of rag fabrics as additional wefts and closely arranged additional warp threads to form check patterns and border designs. The edges of the rug are then bound with tape, and the fabric may be stencilled. —T. W.

Looms. J. Graham, Liverpool. E.P. 170,142, Oct. 20, 1921. (Appl. No. 22,422/20.)

Relates to a miniature loom or weaving device made from sheet metal adopted to hold cloth beam, warp beam and shedding apparatus. —T. W.

Lease Comb and Reed. Thomas K. Rea, Charlotte, N.C. U.S.P.1,390,162, Sept. 6, 1921. Appl. 5/4/21. (4 claims: 1 printed.)

A lease comb and reed has in combination a series of dents formed of resilient metal strips each having their opposite sides bent inward intermediate of their length to form a groove with rounded lips on either side thereof, of a second series of dents each provided with a prong adapted to project into the groove of the opposite dent, the said first and second series of dents being grouped in pairs with an unobstructed passage for the yarn between each of said pairs on the reverse side of the dents from said tongue and lips, respectively. —T. W.

Picker Check. Edward Friar, Hope, R.I., Assr. of one-half to John P. Craig. U.S.P.1,389,823, Sept. 6, 1921. Appl. 7/6/21. (2 claims: 1 printed.)

A picker check for looms comprises a bracket adapted to be bolted in position, a horizontally disposed spring-pressed check arm extending into the path of the picker, a pivot pin rotatably mounted in the bracket to which pin the check arm is fixed, said pivotal pin having a bearing above and below the arm, and a spring acting on said pin whereby the resistance thereof is transmitted through said pin to the arm. —T. W.

Knitted Fabrics. F. W. Tully, Brookline, Massachusetts. E.P.170,171, Oct. 20, 1921. (Appl. No. 24,431/20.)

Gloves, underwear, stockings, and other knitted fabrics are made resistant to unravelling or like damage by treating part of them with a colloid stiffening material, which sticks together the component fibres of the yarn, and renders the loops rigid even when broken. A solution of cellulose acetate in pure acetone, to which is added an equal volume of a clarifier, consisting of equal parts of methyl alcohol and benzol, is used; a softener, consisting of equal weights of salol and triphenyl phosphate, is also added. The solution may be sprayed through a stencil or applied by brushes or a printing block. It may be sprayed on the fabric during the knitting process at any point of manufacture where wear-resisting properties are mostly desired. Cut edges of knitted fabrics may be similarly treated to stiffen them before sewing them together. —T. W.

Thread Knotter. Hugh P. Eanes, Ridgeway, Va., Assr. to Automatic Machine Co., Inc. U.S.P.1,390,103, Sept. 6, 1921. Appl. 22/3/1919. (10 claims: 1 printed.)

A thread knotter comprises a fixed tying-bill, an edge of which forms a cutter, a hook having a cutting edge which co-operates therewith, and a stripper for removing the knot from the tying-bill and actuating said hook to cause the tying-bill and hook to cut a thread extending therebetween. —T. W.

Multiple-feed Circular Spring-needle Knitting Machine. Alfred A. Roy, Lowell, and Peter J. Landry, Pelham. U.S.P. 1,390,164, Sept. 6, 1921. Appl. 20/12/19. (2 claims: 1 printed.)

A circular knitting machine comprises a plurality of needles, a presser, means to hold the presser in position to close said needles successively, yarn-controlled means effective to withdraw said presser to inoperative position, and controlling mechanism for said latter means, said mechanism comprising a latch to hold the presser in operative position, a cam wheel rotatable by engagement with a continuously moving part of the machine, connections from said cam wheel to said latch, and yarn-controlled means for advancing said cam wheel to engaging position. —T. W.

Fabric for Linings and other Uses. Harold I. Huey, Saylesville, R.I., Assr., by mesne assignments, to Sayles Finishing Plants. U.S.P.1,390,292, Sept. 13, 1921. Appl. 15/3/1919. Renewed 7/7/21. (4 claims: 4 printed.)

Refers to a fabric of uniform original texture which has been made permanently stiff except at predetermined folding or cutting lines. —T. W.

Machine for Making and Applying Tufts. Clarence F. Arnold, Philadelphia, Assr. to H. F. Walliser Co. U.S.P.1,390,267, Sept. 13, 1921. Appl. 30/11/20. (15 claims: 1 printed.)

The machine includes a head having prongs forming a notch, means for feeding tuft threads into the notch, and means for feeding a wire to embrace the tuft threads and to be bent by the inner wall of said notch around the tuft threads, one of said prongs having its outer surface concaved to permit finger room to allow a loop to be easily slipped over said prong so as to be bound by said wire to the tuft threads. —T. W.

Intertwisted Net. Takejiro Yamamoto, Tokyo. U.S.P.1,390,325, Sept. 13, 1921. Appl. 29/5/19. (1 claim: 1 printed.)

An interlocked netting joint is formed from two intersecting cords or ropes, each cord comprising three strands, each strand of either cord being passed between two of the three pairs of strands of the other cord, no two strands of either cord passing between the same strands in the same direction, the two cords being subsequently twisted tightly to form a knotless joint. —T. W.

Wall Covering and Process of Making Same. John D. Wiggin, Montclair, N.J., Assr. to H. B. Wiggin's Sons Co. U.S.P.1,390,413, Sept. 13, 1921. Appl. 2/2/16. (14 claims: 1 printed.)

A wall or other covering fabric has a base of woven goods having uneven threads, the unevenness of which has been enlarged after the weaving of the fabric. —T. W.

Seamless Tubular Knit Fabric and Process of Knitting Same. William E. Smith, Milltown, N.J., Assr. to the Interwoven Mills, Inc., New Brunswick. U.S.P. 1,390,827, Sept. 13, 1921. Appl. 5/6/19. (9 claims: 1 printed.)

The process consists in feeding a continuous main knitting thread circularly and continuously in the same direction, and forming a plurality of circular courses of stitches and preventing the formation of stitches through portions of single courses located in the same segment of the fabric, to produce single partial courses of stitches in the other segment of the fabric between adjacent circular courses knit with the same thread, all the stitches of the circular and partial courses being of substantially the same size. —T. W.

Attachment for Looms. Ernest E. Webb, Baltimore, Ind., Assr. by direct and mesne assigments, of one-third to George D. Fryfogle and one-third to Eugene H. Timanus. U.S.P.1,390,943, Sept. 13, 1921. Appl. 26/12/19. (10 claims: 1 printed.)

A weft replenishing loom has a lay, a shuttle box thereon, a reciprocating thread catcher adapted to engage the weft between the shuttle box and the discharged weft carrier at the time of weft change, and means permanently connected to the thread catcher and to a working shaft of the machine to move the thread catcher reciprocatingly towards and from the lay. —T. W.

Elastic Fabric. Meyer W. Schloss, New York, Assr. to Treo Co., Inc. Original U.S.P.1,359,112, Reissue 15,196, Sept. 13, 1921. Appl. 1/7/21. (5 claims: 5 printed.)

Relates to an elastic fabric consisting of a series of parallel elastic cords spaced apart and connected by cross threads running back and forth in close relation between each alternate cord and the next adjacent cords, the cross threads appearing a number of times in each alternate cord to provide staggered open spaces in relation to the staggered groups of cross threads. —T. W.

Knitting Needle Unit. J. Frank Wilcomb, Norristown, Pa., Assr., by mesne assignments, to Spartan Needle Co., R.I. U.S.P.1,391,033, Sept. 20, 1921. Appl. 12/4/19. (30 claims: 1 printed.)

A knitting instrument comprises a hooked yarn drawing element, and a loop spreading element; the latter has a point to penetrate the loop at the back of the hooked yarn drawing element, and there initiates the spreading of the loop for casting over the hook. —T. W.

Needle for Knitting Machines. Wilson Worth Burson, Rockford, Ill., Assr. to B.Z.B. Knitting Co. U.S.P.1,391,043, Sept. 20, 1921. Appl. 4/8/17. (9 claims: 1 printed.)

A needle for knitting machines comprises a knitting hook and a lifting hook and a pivot arm connecting the two, said pivot arm lifting the lifting hook as the knitting hook moves on its knitting stroke to raise the old loop above and over the new. —T. W.

Let-off Mechanism. Albert Bernard Weissenborn, Appleton, Wis., Assr. of one-half to Appleton Wire Works. U.S.P. 1,391,435, Sept. 20, 1921. Appl. 16/7/18. (13 claims: 1 printed.)

The mechanism comprises a warp beam, a tension lever connection therewith for turning same backwardly, and means actuated by the play of the tension lever for varying the connection between the tension lever and the warp beam to produce a let-off. —T. W.

Picker Stick. Henry W. Morgan and James O. Whitener, Greenville, S.C. U.S.P.1,391,266, Sept. 20, 1921. Appl. 8/8/21. (5 claims: 5 printed.)

Relates to the combination of a picker stick and a flexible check-strap, and a freely rotatable roller appliance mounted in the stick in the plane of the strap and having a length approximately equal to the width of the strap. —T. W.

Carrier for Braiding Machines. Joshua B. Hale, Providence, R.I., Assr., by mesne assignments, to Textile Engineering Co., R.I. U.S.P.1,391,682, Sept. 27, 1921. Appl. 2/2/20. (11 claims: 1 printed.)

A carrier for braiding machines has a rotatable yarn take-up member provided with a yarn-guiding passage way leading from its centre portion to its periphery, a yarn release, and means on said take-up for operating said release when more yarn is required. —T. W.

Manufacture of Tapestry or Printed Carpets, Rugs, Table-covers, etc. James Morton, Carlisle, England. U.S.P. 1,391,785, Sept. 27, 1921. Appl. 4/4/19. (6 claims: 5 printed.)

Tapestry and similar or printed fabrics have the body design printed separately from the cross border yarn, the printing being effected on a drum small enough to print only one repeat of the body design, the printed cross border yarn and the printed body yarn being set on separate beams and woven in the tapestry loom, the yarn from one beam being put out of action when the yarn from the other beam is in action and vice-versa. —T. W.

Warp Tension Controlling Mechanism for Looms. Henry W. Youngquist, Manchester, N.H., Assr. to Draper Corporation. U.S.P.1,391,928, Sept. 27, 1921. Appl. 8/9/20. (9 claims: 2 printed.)

Warp beam controlling mechanism for looms has a warp beam provided with a friction drum comprising a brake band anchored at one end engaging said drum, a brake lever connected to the other end of said brake band, having a main section fulcrumed upon a pivot on the loom side and a supplemental section also fulcrumed upon said pivot, yielding means connecting said lever sections and means operating upon said lever when the lay reaches a predetermined position in its beat-up to cause said brake band to lock the warp beam against rotation. —T. W.

Lace. Lawrence Dinkelspiel, West New York. U.S.P.1,391,943, Sept. 27, 1921. Appl. 10/12/19. (9 claims: 1 printed.)

Silk lace embodies a plurality of contiguous consecutive relatively non-extendible portions positioned in successive sequence, and extendible binding portions binding the relatively non-extendible portions together. —T. W.

Needle Loom. Solomon Kendrick, Chelsea, Mass., Assr. to Everlastik, Inc., Boston. U.S.P.1,391,958, Sept. 27, 1921. Appl. 5/1/21. (14 claims: 3 printed.)

A needle loom has an oscillatory needle and means for operating it to lay a loop of weft thread in the shed, an oscillatory shuttle arranged to enter and pass a selvage thread through said loop, and movable about a horizontal axis transverse to and below the warp. —T. W.

Loom Plate and Hanger. Adolph Olevin, Detroit, Mich. U.S.P.1,390,921, Sept. 13, 1921. Appl. 28/1/20. Renewed 3/8/21. (4 claims: 1 printed.)

The device comprises a supporting bar of an inverted U, with upwardly extending side flanges forming parallel troughs on either side, a loom plate, means for supporting a fixture positioned below said loom plate, provided with two parallel upwardly extending arms projecting through said loom plate on opposite sides of said bar, said arms being bent over at their extremities so as to overhang the side flanges of said troughs, means for tightening said loom plate against said bar. —T. W.

Cop Cone. John O. McKean, Westfield, Mass., Assr. to Foster Machine Co. U.S.P.1,391,961, Sept. 27, 1921. Appl. 22/9/20. (4 claims: 3 printed.)

A winding machine has, in combination, a driving roll divided into a cylindrical member and a flaring member, a rigid cop cone, its winding surface having a gradual taper opposite the cylindrical member terminating at its smaller end in a steeper taper in the same direction opposite the flaring member. —T. W.

Fan for Textile Mills. Joseph D. Turner, Huntsville, Ala., Assr., by direct and mesne assignments, of one-fourth to M. A. Shields and one-fourth to Milton C. Giles. U.S.P.1,392,029, Sept. 27, 1921. Appl. 1/12/17. (4 claims: 1 printed.)

Relates to the use of an exposed fan supported for rotation on a textile machine, and having spaced wings to displace lint, etc. —T. W.

Loom Attachment. William H. Dumas, Lebanon, N.H., Assr. of one-half to Joseph Moore. U.S.P.1,392,126, Sept. 27, 1921. Appl. 11/7/18. (1 claim: 1 printed.)

The device consists of a picker stick, a sweep stick, a plate mounted on one side of the picker stick and provided with slots extending longitudinally of the picker stick and also provided with apertures in approximate alignment with the slots, slotted straps extending on opposite sides of the sweep stick and passing respectively through the slots in the plate, and a staple member passing around the picker stick and through the apertures in the plate, means for securing the staple to the plate, and means for pivotally connecting the straps with the plate. —T. W.

Gauge for Looms. Jacob Dudash and Isadore Dudash, Lawrence, Mass. U.S.P.1,392,125, Sept. 27, 1921. Appl. 1/9/20. (1 claim: 1 printed.)

A cloth weaver's gauge comprises a graduated bar, a pair of spaced prongs fixed at right angles to one end of said bar, the prongs being adapted to enter between the threads of the warp, a slide movable on the bar with means for clamping the slide in adjustment, and a plate extension on the slide adapted to engage over the breast of a loom. —T. W.

Picker Stick Cushioning Means. Thomas Parkinson Haydock, New Bedford, Mass. U.S.P.1,392,154, Sept. 27, 1921. Appl. 8/8/21. (4 claims: 3 printed.)

Picker stick cushioning means comprises a body in which is a pocket open at its upper side to confine a cushion against an opposed loom portion, the end of said pocket being bifurcated to enable a picker stick to act against the cushion, and the inner and upper portion of the pocket being shouldered. —T. W.

4.—CHEMICAL AND OTHER PROCESSES.

(B)—SCOURING AND DEGUMMING.

Protectol for Wool Scouring. Textilberichte, 1921, **2**, 353.

A new fibre protector, Protectol, is added to alkaline liquors to reduce or completely prevent injurious action on the wool fibre. Protectol I. is used with caustic alkalies for mercerising and with ammonia for vat dyes. Protectol II. is added to scouring liquors so that a higher temperature may be used, i.e., above the melting point of wool fat, thus giving more complete saponification and maintaining the good properties of the wool intact. The amount of Protectol II. added is usually half the weight of alkali or an equal weight. —H. R. H.

Finishing Buckskins; Modern Methods of——. See Section 4K.

(G)—BLEACHING.

Bowking Liquor and its Regeneration. M. Freiberger. Textilberichte, 1921, **2**, 345-348.

Analyses are recorded of a kier liquor (a) after one "boil," (b) after two "boils," (c) spent, and (d) regenerated. The liquor originally contained about 3% of sodium hydroxide, and 375 litres were used for 100 kilos. of cotton. The spent lye is causticised by means of lime, and bleaching powder is added until the yellowish colour just persists. A small quantity of sulphite or bisulphite is then added, thus promoting further decolourisation. A small quantity of this revivified lye has the same bleaching effect as considerable quantities of the used liquor. It is also stated that distilled water dissolves 2·48% of cellulose from American cotton in 3 hrs. at 125°C. or 0·62% from Maco cotton; that spring water dissolves 0·52% of cellulose from Maco cotton in the presence of air or 0·31% in the absence of air; that 2% sodium hydroxide dissolves 4·26% of cellulose in 6 hrs. at 135°C.; and that loss of cellulose suffered by a fabric in the kier is 8·2% in the absence of air or 12% in the presence of air. The percentages of water, ash, fat (wax), nitrogenous substance, etc., in American cotton, Maco cotton, and in cotton fabric after treatment with "diastofer" are tabulated, but no analytical details are given. —J. C. W.

The Influence of the Concentration of Bleach Liquors on the Stability of Cotton in Prolonged Chlorine Bleaching. P. Heerman and H. Frederking. Textilberichte, 1921, **2**, 428.

If sufficient chlorine is present the velocity of bleaching is proportional to the concentration, but if the chlorine content is low it depends on the rate of diffusion. The thicker the fibre is, the more rapidly it should be bleached. The authors have carried out a series of experiments, using the same material and bleach as in a previous communication (See *Jl.*, 1921, **12**, 446). The duration of each bleaching was 75 mins. with a chlorine content of 1:1000; 5, 10, and 16 bleachings reduced the tensile strength to the same extent as 18, 35, and 50 with a 0·5:1000 concentration. Comparing a concentration of 2:1000 with 1:1000 it was found that in the cases of 2:1000 active chlorine 4, 10, and 20 bleachings resulted in the same reduction in strength as 10, 28, and 50 with a concentration of 1:1000. Seven bleachings with 2:1000 concentration gave the same loss in strength as 50 of 0·5:1000. Generally, by doubling the chlorine concentration the loss in stability was increased threefold. The weight per square metre was reduced about 9%. The elasticity in the case of concentrations of 2:1000 fell about 20%, but in the case of 1:1000 it rose to a maximum of 113% after 20 experiments and then fell to 105% after 50 bleachings. —E. B. A.

Oxygen Bleaching. F. H. Thies. Textilberichte, 1921, **2**, 349.

Oxygen bleaching is compared to chlorine bleaching, generally in favour of the former. No antichlor is required, and the so-called oxygen corrosion applies equally to both methods. Although the cost of the oxygen bleach is higher for the materials used, a saving in steam compensates for this. —H. R. H.

Bleaching; Rosin in——. Cotton, U.S.A., 1921, **85**, 938-939.

A short account of the value of rosin in bleaching is given. Its use is to be deprecated in the case of fine goods or those requiring a pure white. —L. M. S.

(H)—MERCERISING.

Cellulose; Studies on——. I. The Hydrogen Capillary Viscosimeter and its Applications. See Section 6.

Mercerisation after Dyeing. Text. Colorist, 1921, **43**, 757-758.

The mercerisatiin of cotton yarn and cotton fabric after dyeing is receiving considerable attention because it is easier to produce even shades on unmercerised cotton and because of the liability of the dyeing process to injure the mercerized effect with consequent loss of brilliancy of lustre. A list of American made dyes which will stand after-mercerisation without damage to the shade is given.
—L. M. S.

(I)—DYEING.

Alkalies in Vat Dyeing. L. Kollmann. Textilberichte, 1921, **2**, 379.

The leuco compounds are most soluble in strong inorganic alkalies, caustic soda, or lime. Dyeing with vat colours is possible when the leuco compound is in complete solution or in a finely dispersed suspension. Such suspensions are obtained by decomposing the soluble vat with sodium bisulphite, bicarbonate, etc., or previous reduction in the presence of weak alkalies. Suspension vats do not give as good results as when a true solution is used. Weak alkaline vats are only required for wool. Concentrated hydrosulphite alone effects very little reduction of indigo; some weak alkali is essential—even calcium carbonate will serve. The author mentions a vat in which zinc oxide or prepared chalk are used as bases—for instance, a vat made as follows:—3% indigo 20%, 15% prepared chalk, 10% hydrosulphite on the weight of wool, in a vat 1:100 on the wool, at a temperature of 75°C., in 1hr. gave a dark blue, which was as fast to milling and rubbing as if dyed in an ordinary vat.
—H. R. H.

Acetyl Silk; Dyeing of——. J. F. Briggs. Jl. Soc. Dyers and Col., 1921, **37**, 287-296.

A detailed account is given of the methods used. It is stated that the dyeing of acetyl silk is not more difficult than the dyeing of any other artificial fibre. The Azoic process offers attractive possibilities of future extension and gives dyeings of unexampled solidity and brilliancy.
—F. C. W.

Fastness to Washing. G. Emmons. Silk, N.Y., 1921, **14**, 69.

The distinction between fastness to washing and to water is made plain, and the importance of the former in silk dyeing is emphasised. Many substantive dyes, especially those of the diazo class, are said to be very useful for silk, though lacking in brilliancy. Notes on the method of dyeing and a list of suitable dyes are given, and also practical details for dyeing with colours of the diamine class. —F. G. P.

Fluorescent Shades on Union Goods. Posselts' Text. Jl., 1921, **29**, XVI.

The method for dyeing cotton and wool mixtures for fluorescent effects is given, and some colour combinations suggested.
—L. M. S.

Dyeing and Brightening Alizarine Red; The Importance of the Addition of Tin Salts in——. R. Haller. Textilberichte, 1921, **2**, 427.

The author has previously obtained from colloidal alumina and alizarine a body which differs from that obtained by double decomposition by its pronounced colloidal character. He now finds that on adding a few drops of a very dilute solution of alizarine to a colourless stannic acid hydrosol, shaking and standing, a faintly opalescent solution of pronounced orange red colour is obtained. Further, the calcium-aluminium alizarine lake is capable of adsorbing considerable quantities of this colloidal tin compound with considerable yellowing of shade. On heating a solution of sodium palmitate, stearate, or soap with tin salts a stannic acid hydrosol is formed, capable of forming the yellowish colloidal tin alizarine compound. The author gives the following theory for the action of tin salts. The tin salts added to the soap solution form a small quantity of stannic acid sol, which forms with a small quantity of unaltered alizarine liberated from the cloth, the colloidal tin-alizarine compound of distinct yellowish red colour. This is energetically absorbed by the calcium-aluminium lake, and the colour changes from a bluish red to the desired fiery scarlet. —E. B. A.

Vat Dyes for Wool. Textilberichte, 1921, **2**, 352.

The use of vat dyes for wool is recommended. The advantages claimed are:—Better results, less loss in milling, improved fastness and elasticity of the wool when compared with chrome dyed colours. The low temperature of the dyeing operation maintains the wool in a soft and loose condition. The saving of coal is important: 100lbs. of wool requires 34lbs. steam for dyeing with vat colours, whereas a chrome dyeing requires above 340lbs. of steam. —H. R. H.

Cellulose-acetate and Viscose Silks; Notes on——. See Section 6.

(J)—PRINTING.

Continuous Steamer. Karl Reinking. Textilberichte, 1921, **2**, 309-310.

The author mentions a number of interesting cases of failure in calico printing, especially in the use of rongalite, all of which he traces to the insufficiency of moisture in the steamer. The examples include the production of Prud'homme-black, chlorate discharge, printing with vat dyes, and the " leucotrope " discharge. The steamer should be connected as directly as possible to the boiler, be fed with saturated steam at low pressure, and rapid rises in the steam mains should be avoided. Failing these ideal conditions, some arrangement should be made at the steamer for saturating the steam.
—J. C. W.

Caustic Soda Crimp Effects in Cotton Cloth. R. Sansone. Canad. Text. Jl., 1921, **38,** 599.

The modern method of producing these effects in cotton cloth is by means of the ordinary one colour printing machine where the usual engraved copper boal and doctor are substituted by an engraved steel boal and steel doctor. A very thick cotton backcloth is employed for the protection of the thick woollen blanket placed just below, the cotton cloth having been treated with caustic soda under special conditions until no further contraction is possible. On leaving the printing machine, the cotton fabric is carried straight away on to a pair of endless chains that allow it to shrink only to a certain width. After this it is carried through a hot-air oven from which it is delivered to the bleaching department. A printing paste recommended is: 600 parts British gum or dextrin, 100 water, and 600 caustic soda lye at 40° Bé. Less pronounced crimped effects can be obtained by using caustic soda lye from 20° to 25° Bé. —W. D.

(K)—FINISHING.

Finishing Buckskins; Modern Method of——. Hahn. Textilberichte, 1921, **2,** 384.

After burling, the pieces are entered directly into the cylinder milling machine, 1—1½ cans of soda solution (5°—6°Bé) added per piece and after running for 5—10 min. one-half can of soap solution added. If the material runs dry this is a sign of an inferior oil, and soda solution of 8°—9°Bé should be used. Scouring is carried out in a washer, which must be large enough not to cramp the goods. The following directions are given:—Add a little condensed water and one can of soda solution (not hot) and run for ½—¾ hr., carefully rinse with warm water for 20—30 min., add another half a can of soda solution and some fat solvent, and run for another ½ hr.; rinse with tepid water in a fine spray, gradually increasing, and after 1½—2 hrs. clear with cold water. Treat with hot water (30—40°C.) for 5—7 min. and put on to rollers, dry, burl, steam slightly, and cut, not too short. For felted buckskins a brushing with a wire brush is necessary. The goods should be well pressed on the rotary press, steamed well, dried at once, and again pressed without tension. To give the material a more worsted appearance, mill, scour, dry, burl, cut, press, and steam 1—2 min. at 1½ atmos. pressure, pass through water of 35°C. for 5 min., roll without tension, tenter, cut, and finish as before. —H. R. H.

Different Methods of Producing High Polish Effects on Silk Fabrics. R. Sansone. Text. Colorist, 1921, **43,** 745.

Some forms of calenders are unsuitable for delicate silk fabrics; if two faces of cloth are put through together a moire effect is produced. An inferior polish may be obtained by a rapidly working revolving brush. The present object of silk dressings appears to be to make the silk look like leather. Silk fabrics are treated with various solutions to produce the hard shine. Treatment for 2 or 3 mins. with 90% formic acid causes the fibre to swell up, contract, and become gelatinous; the fabric is then washed in water, stretched and dried, and is said to be more lustrous and no less strong. An application of formic acid to the surface, followed by warm calendering, is also suggested. A thin dress of celluloid dissolved in 94% alcohol and applied by means of a mangle or brush, and followed by drying and a hot calendering is recommended. Nitrocellulose solution is said to be applied to the fabric, dried off, and the fabric calendered. Viscose solution in water and acetyl cellulose are also stated to be useful. Suitable formulæ are:—A mixture of 75 parts of acetyl cellulose with 15 parts of tri-phenyl phosphate and 10 parts triacetin dissolved in alcohol and carbon tetrachloride; a solution of 10 parts of acetyl cellulose in 80 of chloroform and 10 of acetone. —F. G. P.

PATENTS.

Singeing Cloth. Selas-Turner Co., Ltd., Coventry, and E. Turner, Manchester. E.P.169,248, Sept. 19, 1921. (Appl. No. 16,590/20.)

Cloth singeing plates or rollers, heated by gas or liquid-fuel burners, are perforated or slotted so that the products of combustion vent through the cloth treated. The vents may be closed by plugs or slides to suit different widths of cloth. The plates or rollers have a surface broken by corrugations or pockets, and are preferably made of non-oxidizing alloys, such as nickel and chromium or iron and aluminium, or they may be made partially or wholly of a refractory material. In one form, ribs *c*, Fig. 6, are arranged spirally in opposite directions at each end so as to act on a scrimp rail, and the plate is slotted as at *e*. In a modification, Fig. 13, channel members *f* are embedded in refractory materials *h*. Holes or slots *h'* form burner orifices, combustion taking place in the channels *f*. —T. W.

FIG. 13.

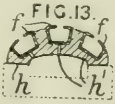
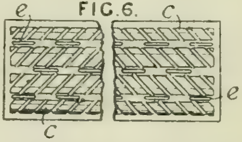


FIG. 6.



Dyeing Machine. Howard M. Dudley, Philadelphia. U.S.P.1,390,512, Sept. 13, 1921. Appl. 26/11/19. (9 claims: 1 printed.)

A dyeing machine has, in combination, a dyeing chamber, two series of spaced parallel bars capable of holding skeins in a substantially taut condition, and means for circulating a liquid in reverse directions through the dyeing chamber parallel to the length of the skeins. —T. W.

Dyeing Yarns, etc. International Textile Devices, Inc., Salamanca, New York, U.S.A. E.P.170,273. (Appl. No. 22,248/21.) Conv. Oct. 15, 1920.

A vat for dyeing tops, yarn, etc., has perforated tubes 15, Fig. 5, upon which are mounted collectively collapsible perforated tubular yarn spools 10, upon which the tops are wound, means being provided for forcing the dyeing or mordanting liquid or gases through the tubes. The tubes are mounted in a false bottom 18 of the vat, and the spools of tops are placed on the tubes with the smaller diameter of spool downwards. The upper end of each tube is closed by a plug 28, and is provided with a weight 29, a heavy cover 30 of the vat resting on the weights 29. Fluid is circulated by a pump through a distributing chamber 17, the tops, and the vat, a valve being provided to reverse the direction of flow as required. The spools 10 are made of slotted sheet metal 11, Fig. 2, or perforated sheet metal 12, Fig. 3, a wire or other binder 13 being provided at each end of the spool. In another form, the spool is made of non-rusting woven wire 14, Fig. 4, having brass or non-rusting binding 14¹. —T. W.

FIG.2.

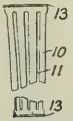


FIG.3.

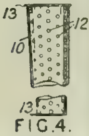


FIG.4.

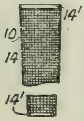
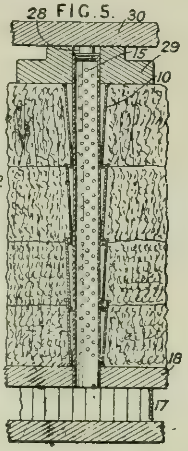


FIG.5.



Apparatus for Finishing Velvet and other Nap Fabrics. Joseph Cucumel, Lyon, France. U.S.P.1,390,093, Sept. 6, 1921. Appl. 8/4/20. (1 claim: 1 printed.)

The apparatus consists of a frame, a table, a reservoir containing a liquid for the humidification of the fabric, rollers in the reservoir, a card comprising two cylinders provided with steel teeth, means for regulating the pressure of the cylinders, heating means for the nap-raising mechanism, a calender arranged for the heating means and also heated thereby, means for regulating the height of the calender, a second card in rear of the calender and rotating in the opposite direction to the first card, a stretching frame above the table, means for regulating the inclination of the stretching frame, and means for guiding the fabric to the table where it is piled up. —T. W.

Textile Fabric Treating Machine. Louis Clarenbach, Passaic, N.J. U.S.P. 1,389,627, Sept. 6, 1921. Appl. 18/11/20. (6 claims: 1 printed.)

A vat for treating textile fabrics in open width with liquid consists of a compartment, a frame structure in the latter with fabric carrying rollers, means for operating the frame to cause the fabric to engage the liquid flatwise while in the substantially vertical position, and means for feeding the fabric through the compartment. —T. W.

Fabric Laying Machine. Isaac Segal, New York. U.S.P.1,389,906, Sept. 6, 1921. Appl. 12/7/19. (7 claims: 1 printed.)

A cloth folding machine has, in combination, a carrier, a table adapted to run thereon, means located upon the carrier for grasping the cloth so that the carrier will pull the same over the table, a plurality of presser rolls carried by the table adapted to engage the cloth piled thereon, and means upon the carrier for lifting the presser rolls from the cloth as the carrier passes thereby. —T. W.

Machine for Piling Fabric. Alois Tscherne, Rorschach, Switzerland. U.S.P.1,390,253, Sept. 6, 1921. Appl. 22/6/20. (3 claims: 1 printed.)

The machine has, in combination, a fabric supporter adapted to reciprocate in vertical direction and also in horizontal direction cross-wise of the direction of fabric feed, a stationary fabric gripper, and a fabric looper adapted to reciprocate in horizontal direction lengthwise of the direction of fabric feed, and means for operating said parts in timed relation. —T. W.

Machine for Cutting Embroidery. Alois Tscherne, Rorschach, Switzerland. U.S.P.1,390,254, Sept. 6, 1921. Appl. 16/9/20. (12 claims: 1 printed.)

A machine for cutting along the edge of embroidery comprises, in combination with the machine frame and a motor, circular cutting means adapted to be vertically rotated by the motor, gate members forming the intake for the fabric to be cut and located directly in front of said cutting means, a fold-preventing and fabric-feed facilitating nose on the lower one of said gate members, guide rolls adapted to feed and guide the fabric to the circular cutter, two pairs of horizontally rotatable feed rollers located in the rear of the circular cutter, the one of these roller pairs handling the waste fabric portion and the other the embroidered fabric and one roller of at least one of said roller pairs being swingingly arranged, controlling organs operatively connected to said guide rolls and adapted to be operated for controlling the fabric feed, a guide member for drawing away the cut-out embroidery portion from the said gate members and for lifting and twisting it, means for controlling the rotary speed of said feed rollers, and means in connection with the main drive coupling for instantaneously starting or stopping the machine. —T. W.

Printing Attachment for Knitting Machines. George S. Weinerth, Reading, Pa. U.S.P.1,390,660, Sept. 13, 1921. Appl. 23/11/20. (4 claims: 2 printed.)
Fabric printing mechanism for circular knitting machines comprises an attaching frame having operating lever supports and a slide-way bracket with an extension forming a fabric way, a reciprocative bed member in said slide way, a pivoted inking device, means carried by the bed member operating to swing positively the inking device to operative and inoperative positions incident to the retracting and advancing movements respectively of the bed member and lever mechanism for operating said reciprocative platen member. —T. W.

Process for Increasing the Firmness of Silk. Korselt. F.P.514,594. Appl. 19/4/20.
The silk is treated with organic compounds containing nitrogen or sulphur. The alkaloids, for instance, cinchonin and its derivatives, are very suitable for this process. The silk is dipped in a solution containing 10% (of the weight of the silk) of cinchonin at the ordinary temperature. The cinchonin can be fixed by a soluble soap. After treatment the silk is hydro-extracted and dried. It possesses a firmness 10 to 50% superior to that of ordinary silk. —Bur. Text.

Bleaching, Dyeing, Washing, and Soaping Cylinder for Knitting Mills, Dyehouses, Bleacheries, and Laundries. Dean Brown Becker, Port Atkinson, Wis. U.S.P.1,391,712, Sept. 27, 1921. Appl. 2/3/21. (5 claims: 1 printed.)
A device for treating textiles with liquids comprises a casing, a foraminous cylinder mounted for rotation therein having opposite doors in the outer annular wall thereof, the cylinder having opposite ends provided with pairs of ribs with grooves in alignment between the said doors adapted for the removable reception of perforated, slotted, or foraminous shelves at adjustable elevations. —T. W.

Bleaching Fabrics. C. Taylor, Paterson, New Jersey, U.S.A. E.P.168,995, Sept. 12, 1921. (Appl. No. 15,917/20.)
Cloth in rope form is passed from a singeing or padding machine to squeezing and drawing rollers, and to driven rollers or drums which feed the cloth to automatic pilers arranged over iron kiers in which the whole of the fabric is treated simultaneously. After treatment in the kiers, the fabric passes between the rollers of a mangle and thence to the pilers of two wood kiers. The rope-like form of cloth passes from the wood kiers, through expanders, to folding or plaiting-down devices. The liquid is forced through the pilers together with the fabric while it is being passed into the kiers. The pilers may be of the kind described in Spec. 138,845. All the parts are in a row. —T. W.

Cloth Winding and Measuring Machine. Walter E. Hosch, St. Louis, Mo., Assr. to the Measuregraph Co. U.S.P. 1,390,957, Sept. 13, 1921. Appl. 15/1/15. Renewed 12/2/21. (21 claims: 17 printed.)
The machine has, in combination, a pair of reels and means for driving them, a differential gearing associated with the said driving means, and means associated with said driving means having one position for driving said reels in one direction, and another position for driving the reels in the other direction. —T. W.

Treating Fabrics. J. T. Robin, Streatham. E.P.169,277, Sept. 22, 1921. (Appl. No. 16,898/20.)
A process of de-nitrating fabrics impregnated with a solution of thorium and cerium nitrates, particularly those used in the manufacture of gas mantles, consists in heating a solution of ammonia to produce ammonia fumes within or practically within a closed container in which the dried fabric is placed. In one form of apparatus, ammonia solution in a vessel is heated to boiling point by a burner, and the fumes pass through a sleeve into an asbestos-lined cupboard provided with a door. A gauze screen is slidably mounted on bars, and the dried impregnated fabric is suspended on aluminium rods carried by a frame mounted on similar bars in the cupboard. An opening at the top of the cupboard has a slidable cover, and leads to a flue connected to a casing containing an electrically-driven fan, while a projection on the cover serves to indicate when the cupboard is open or closed. A series of such cupboards may be employed. Excess of ammonium nitrate deposited on the fabric is removed by washing in distilled water. —T. W.

Feeding Webs. Addressograph, Ltd., and P. Battey, London. E.P.170,121, Oct. 20, 1921. (Appl. No. 21,765/20.)
Relates to an intermittent-feed mechanism and other mechanism arranged to deliver a web of paper, cloth, or other material normally slightly less than that taken by the intermittent-feed mechanism, while a supplementary mechanism is provided to increase the amount so delivered when required. —T. W.

Teazling Machines. Fabricless Products, Ltd., London, and G. E. Andrew, Northwood. E.P.169,237, Sept. 19, 1921. (Appl. No. 16,420/20.)
The teazles are threaded on rods carried by a rotating cage, and are prevented from rotation on the rods by sleeves which engage the teazles either positively by flanges or by friction. The sleeves are open at the top to allow the teazles to operate upon the material. Each sleeve is provided with a flanged portion secured to an end plate of the cage, and is supported at the other end by a bracket. —T. W.

Treating Hanks with Liquids. F. Linneman, Premnitz, Germany. E.P.169,695. (Appl. No. 24,573/21.) Conv. Oct. 1, 1920.

Open or closed hanks of artificial fibrous material such as staple fibres, artificial silk, horse hair, etc., are dipped by mechanically operated raising and lowering gears into a series of baths, the fibres being loosened and penetrated on dipping and drained when the hanks are raised. The hanks are suspended on rotatable rectangular rods mounted in frames having a vertical travel greater than the length of the hanks. The rods are caused to travel on the frame in its raised position so that the hanks are dipped successively into all the baths. Means are provided to supply a definite quantity of liquid to each bath during each reciprocation of the frame. The hanks may be sprayed when they are in the raised position. —T. W.

Colouring Fabrics. Zimmer's Erben, F., Grosschonau, Germany. E.P.169,710. (Appl. No. 25,704/21.) Conv. Feb. 10, 1920.

A modification of the parent Invention 157,328 for colouring webs consists of a device for automatically stopping the machine when the spraying nozzle is in an end position. —T. W.

Imitation Textiles. B. Borzykowski, Berlin. E.P.22,826/13, in place of 22,826 not yet accepted. [See Illustrated Official Jl. (Patents), Vol. 34, p.5100.]

Relates to a method of producing imitation textile goods of a lace-like, perforated, or open-work character by means of solutions of cellulose or other viscous materials and engraved rollers. The layer drawn up by the rollers is removed by suitable stripping or doffing mechanism, after which the lace-like layer is made to pass through different baths before being delivered as a finished product.

Machine for Washing, Saturating, and similarly treating Textile Fabrics and Yarns in Rope Form. F. Roberts, Assr. of one-half to the Calico Printers' Association, Ltd. U.S.P.1,391,276, Sept. 20, 1921. Appl. 1/11/19. (4 claims: 1 printed.)

The apparatus consists of a liquid receptacle divided into a plurality of compartments, each having a perforated false bottom, each compartment communicating with a succeeding compartment below the false bottom thereof, means for supplying a liquid to the last compartment of the series, means for conducting a rope of textile material into and out of successive compartments, the direction of progress of said rope being counter to the flow of liquid through the receptacle, and adjustable means for guiding said rope in its passage from one compartment to another. —T. W.

6.—ANALYSIS, TESTING, GRADING, AND DEFECTS.

Physical and Chemical Properties of Spun Floss Silk. L'Avenir Text., 1921-22, No. 1, 4.

Floss silk when ready for carding, etc., contains 40% and over silk gum. The weight of floss removed from the cocoon before reeling is from 1—1·5% of the total live cocoon; it is higher in Asiatic silks and defective cocoons. Spun floss readily parts with its gum in boiling water; it has been suggested that this could be modified by partially hydrolysing the gum by fermentation before carding. Trials have shown that if floss is allowed to remain in pure water until the albumen begins to decompose with liberation of ammonia, the extract of sericin obtained in boiling water will not gelatinise on cooling, and the silk will give up about 5% of sericin in warm water. Spun floss appears to behave in the same way. Although the sericin of the cocoon skins is slowly soluble in boiling water it dissolves rapidly at 120°C., while that of raw floss and the other wastes dissolves easily and rapidly at the boil when the cocoons are new. It is said that the silk literature does not allude to this property of undried silk. A table is given showing the marked difference between living and dried cocoons. Spun floss fibres may be distinguished microscopically by fragments of the outer-net adhering to the spun floss. Spun floss should not be sold as ordinary spun; the term "schappe blaze" is used. —F. G. P.

Standard Raw Silk Classification. Amer. Silk Jl., 1921, **40**, 53.

Another report has been issued by the Silk Association of America on this subject. Four grades are proposed which have no relation to the present market classification. The values are based upon a large number of tests in various laboratories, and it is thought that they will furnish producers with standards to work to, give a systematic idea of requirements, and encourage the search for accurate information. The following are among the figures given for the four grades:—Tenacity in grams per denier, 3·75, 3·50, 3·25, 3·00; elongation, 20%, 18%, 16%, 16%; evenness defects, not over 5, 10, 20, 30 for 13—18 deniers; winding (breaks in 100,000 yds.), 5, 10, 20, 30. The Standard American Skein aims at uniformity, elimination of gum-tacks, and ease in unwinding. The reel is to be 148—150 cm. in circumference. Full details and illustrations are given of the machines employed. —F. G. P.

Colour Measuring and Recording. Chem. Trade Jl., 1921, **69**, 624.

In the course of a paper dealing with the theory and practice in colour measuring and recording, read before the Oil and Colour Chemists' Association, Mr. A. E. Bawtree presented a method by which, working with a series of scales and a table, colour matching can be carried out on more or less standard lines. —L. M. S.

Estimation of the Degree of Lignification (Lignin) in Cellulose and Wood. R. Sieber. Zellstoff u. Papier, 1921, **1**, 223.

Experiments are described which have been carried out by the methods of Becker and Willstätter and by the indirect method of Fellenberg for the estimation of lignin. Some experimental modifications in the methods are described. The two first-mentioned methods appear to yield too high values for the lignin content. These values, however, can be considered as relative values. The estimation method of Fellenberg can sometimes be used instead of Zeisel's methoxyl-estimation. —L. M. S.

Cellulose; Studies on——. I. The Hydrogen Capillary Viscosimeter and its Applications. M. Nakano. Jl. Soc. Chem. Ind. (from Jl. Chem. Ind. Japan, 1921, **24**, 918-926), 1921, **40**, 807A.

The effect of dry heating at various temperatures, and of mercerisation for various concentrations of soda, on the viscosity of a 0·5% cellulose in cuprammonium hydrate has been examined. In all cases the viscosity was reduced in proportion to the elevation of temperature and the increase in concentration of the alkali used in the mercerisation process.
—F. C. W.

Colloid Chemistry; The Proteins and——. J. Loeb. Jl. Chem. Soc. (from Science, 1920, **52**, 449-456), 1921, **120**, i. 819-820.

An address in which evidence is put forward that, as exhibited by the behaviour of the proteins, the chemistry of colloids does not differ from the chemistry of crystalloids. —F. C. W.

The Constitution of Polysaccharides. Part III. The Relationship of l-Glucosan to d-Glucose and to Cellulose. J. C. Irvine and J. W. H. Oldham. Jl. Chem. Soc., 1921, **119**, 1744-1759.

Lævo-glucosan is shown to be 1:6 B-glucose, for which the name B-glucosan is suggested as being the more appropriate. The trimethyl glucose from glucosan is not identical with that from trimethyl cellulose, so that glucosan has not direct relationship with cellulose. The production of B-glucosan from cellulose by dry distillation under diminished pressure is shown to take place by the preliminary hydrolysis of the cellulose to glucose consequent upon the formation of acids in the process in considerable quantity. Further confirmation of the presence of cellobiose residues in the cellulose unit is obtained by the identity of the trimethyl glucose obtained from cellobiose and that obtained from trimethyl cellulose. The essential part of the research is that B-glucosan bears no structural relationship to cellulose. Pictet's polymerisation hypothesis is shown to be untenable, and the recent work of Reilly on the distillation of methyl celluloses (*Jl.*, 1921, **12**, 325) is shown to have no bearing on the problem at issue.—F. C. W.

Electric Telepsychrometer. J. Cartus. Textilberichte, 1921, **2**, 363-364.

The instrument consists essentially of a bundle of sensitive thermocouples, one end of which is clothed with a mousseline stocking dipping into distilled water, whilst the other end is dry. The current set up by reason of any difference in temperature of the two ends operates a scale at any distant point, such as a central heating, ventilation, or humidification plant, the scale being calibrated in percentage relative humidity. —J. C. W.

Solubility of Cellulose. R. O. Herzog and F. Beck. Color Trade Jl. (from Z. physiol. Chem., 1920, p.287), 1921, **9**, 210.

The solubility of cellulose in concentrated solutions of alkali and alkaline earth salts is a function of the hydration of the ions of the respective salt. In experiments with raw and purified cotton, cotton wool, wood pulp, and hydrocellulose, no swelling or solution occurred in solutions of chlorides, bromides, nitrates, sulphates, thiocyanates, acetates, and lactates of sodium, potassium, ammonium, and magnesium, barium, and strontium bromides and barium thiocyanate. Calcium nitrate attacked the cellulose. Swelling without disappearance of structure occurred in solutions of potassium iodide at 120 to 140°C., and of alkaline earth iodides at 120 to 150°C. Solution of the cellulose took place in solutions of sodium iodide, lithium chloride, bromide, iodide and nitrate, calcium iodide, bromide, and thiocyanate, strontium thiocyanate, and potassium mercuric iodide. "Commercial pure" calcium chloride will dissolve cellulose if the dilute solution is first neutralised with N/100 hydrochloric acid and then concentrated. —L. M. S.

Cellulose-acetate and Viscose Silks; Notes on——. E. Clayton. Jl. Soc. Dyers and Col., 1921, **37**, 301.

The acetate fibre is soluble in acetone, incompletely soluble in chloroform and insoluble in carbon tetrachloride. This indicates that the material is the partly hydrolysed product obtained on treating mixed sulphuric acetates with water. Boiling with water for 2 min. and squeezing alters the physical properties of the fibre considerably with loss of strength; viscose fibre also loses strength on similar treatment, but is otherwise unchanged. Acetate fibre in cold water yields the odour of acetone and alcohol; the addition of iodine and caustic soda gives a precipitate of iodoform. This effect is noticed even if the hank of fibre has been previously heated for two hours at 105°C. Viscose behaves towards dyes like well-mercerised cotton; direct cotton colours topped with basic dyes give reasonably fast bright shades. Some details of dyeing with special colours are given. The effect of diazotising primuline coupled with B-naphthol to get red on viscose and old-gold on acetate fibre is mentioned.
—F. G. P.

Artificial Silk; Hygroscopicity of——. K. Biltz. Deuts. Faserstoffe (from Textile Forschung, 1921, **3**, 89-95), 1921, **3**, 113.
Hygrometric experiments on viscose, copper, nitro, and acetate silk are described and tables given. —L. M. S.

Bowking Liquor and its Regeneration. See Section 4G.

Diameter of Yarns. See *Jl.*, 1921, **12**, 469.

Place of the Physicist in the Textile Industry. See *Jl.*, 1921, **12**, 465.

7.—BUILDING AND POWER.

(A)—CONSTRUCTION OF BUILDINGS.

Gravity Conveyors for Textile Mills. See Section 7E.

(C)—POWER.

Oil Fuel for Textile Works. J. Veen Stevens. Engineering and Industrial Management, 1921, **6**, 597.
Fuel oil, the residue left after abstracting the lighter constituents from crude oil, has a calorific value of about 19,000 B.T.U. per lb. and a flash point above 150°F. Storage tanks should be placed as near as possible to the boilers, and should be fitted with steam heating coils, water drain cock, manholes and vent pipes, the outlet being at least 1ft. above the bottom. One ton of oil at 60°F. occupies 38 c.ft. The oil is atomised as completely as possible by either the air jet, steam jet, or pressure jet system. In converting a Lancashire boiler from coal to oil fuel the type of equipment to be used depends on whether it is to be temporary or permanent and whether oil is to completely replace coal or only to be used for peak loads or as a stand-by. The oil is atomised by the burner, but it must be heated to about 120—130° beforehand, usually in a small feed tank with steam coils. For starting up without steam a special heater and a hand pump are provided. The advantages claimed for oil are:—Increased capacity of boiler; steam raised more quickly; absence of smoke, ash, and dust; reduction of labour; steadier steam pressure. A table of test results is given showing increases of 100% in evaporation per lb. of fuel and 115% in total evaporation, with an improvement in thermal efficiency from 60·9 to 75%. —V. M.

Degree of Irregularity in Textile Machines: Torsiograph. J. Geiger. Textilberichte, 1921, **2**, 279-281.
A torsiograph capable of registering rapid fluctuations in speed is described. Torsiograms are given for various sources of power and methods of transmission as applied to textile machinery. Cog-wheel drives are shown to be detrimental to smooth running. —J. C. W.

Belt Reclaiming. Text. World Jl., 1921, **60**, 71.
A belt press and cutting machine, as used by belt manufacturers, have been installed in cotton mills in Louisville, and a regular system of belt reclamation has been adopted. One man has charge of all belting in the mills. When a belt becomes worn and uneven it is replaced, trimmed down to the next smaller standard width, and put into stock ready for use in a place where it fits. This system keeps all the belting in good condition, saves a lot of scrap, and thereby more than pays for itself. —V. M.

Novel Compound Chain Drive. Text. Mfr., 1921, **47**, 221.
A novel double reduction chain drive has been installed in a silk weaving shed at Letchworth. The drive is from a motor to a lineshaft, and the intermediate chain wheels are fixed together and mounted on a short spindle carried by two brackets which hang from the lineshaft. This eliminates the usual countershaft and bearings and provides automatic adjustment for the first chain. Very large ratios of speed reduction can be obtained in this manner. —V. M.

Fuel Economy by the Adoption of Scientific Management in Steam Generation and Utilisation. David Brownlie. Engineering and Industrial Management, 1921, **6**, 560, 593, 626, 653, 685.
Figures deduced from extensive tests made throughout the country are given to show that there is no reason why the average of the boiler plant efficiencies should not be increased from about 60 to 75%, effecting a saving of 18,000,000 tons of coal per annum. The main features of scientific operation of boiler plants are dealt with as follows:—Flue gas analysis; boiler feed water meters; steam meters; feed water regulators; coal weighing; economisers; feed water heaters and superheaters. —V. M.

(D)—LUBRICATION.

Greasing Machinery for Storage. C. F. Mullin. Text. Mfr., 1921, **47**, 369.
Experiments have been conducted by the Bureau of Standards, Washington, on a suitable substance for preventing deterioration of machinery in storage. Three formulæ have been devised and found to give excellent results on textile machinery: (1) Petrolatum 10 parts, H grade rosin 1 part, kerosene or coal oil 1 part. The rosin is melted and mixed with the previously heated petrolatum, and whilst cooling the mixture is stirred well and the kerosene then added. To make the substance more solid a little candelilla wax may be added as desired. This mixture has been found to be a perfect preservative for bright steel plates exposed outside for about 8 months. (2) Candelilla wax 3 parts, rosin 6 parts, petrolatum 50 parts. (3) Carnauba wax 2 parts, rosin 5 parts, petrolatum 50 parts.

These materials should be heated together to about 125°C. until all the ingredients are melted; the mixture should be thoroughly stirred whilst cooling.—W. D.

(E)—TRANSPORT.

Gravity Conveyors for Textile Mills. W. and C. Pantin. Text. Mfr., 1921, **47**, 208.

It is recognised to be of the utmost importance that mills should be so laid out as to minimise the handling of the material in process. Many mills, however, do not lend themselves to an effective lay-out, and a large amount of handling and carrying of goods goes on, the very large cost of which is often not realised. In many cases manual handling is unavoidable, but there are many cases where the installation of gravity conveyors would effect great saving. A fall of 3 or 4 ft. in 100 ft. is all that is necessary to make material travel by itself without power and without attendance, and there are infinite possibilities for the application of this principle in mills and warehouses. —V. M.

(F)—LIGHTING.

"Wiskott" Daylight Lamp. L. Bloch. Textilberichte, 1921, **2**, 358-359.

This daylight lamp is fitted with two glass filters which rectify the electric light, whilst the loss of about 30% in intensity is more than balanced by an arrangement of mirrors which concentrate the filtered light into the region immediately below the lamp. —J. C. W.

8.—DESIGN.

Suggestions for Design based on Mohammedan or Saracenic Art. E. H. Hankin. Posselt's Text. Jl., 1921, **29**, 23.

The writer asserts that the actual methods of drawing and design, by which the extremely complicated geometrical patterns peculiar to Mohammedan or Saracenic art were drawn, are unknown to modern artists, and explains that the methods of construction of these designs are not simple methods of draughtsmanship, but may be described as methods of design, as by their means it is possible not only to copy old patterns but also to design new ones in conformity with the rules of geometric art, thus providing the foundations for novelties in design to be worked up by the artist. By means of a series of diagrams and pattern plans, the author illustrates how geometrical patterns may be divided into groups, and suggests the simplest methods to facilitate the designer's work in the preparation of some of these strikingly complex designs. —A. E. G. B.

Roumanian Textile and Craftwork Exhibit. Colour Trade Jl., 1921, **9**, 130-131.

An exhibition of interest to textile designers has been arranged in New York City, whereby it is hoped to give a new impetus to students of art and design in the study of the brilliant, gay, and even startling colour combinations in vogue during recent years. This representative collection of work and designs of the Roumanian people includes patterns for embroidered and woven fabrics carried out in table-cloths, scarfs, dresses, etc., in a variety and number of colours unequalled even by the Japanese. The embroideries and designs, as represented in almost every kind of weaving, show that each province possesses its own type of work, the designs produced in the provinces of Valcea, Arges, and Muscel differing in style from the designs of Transylvania, the Banat, and Bessarabia. The designs, while particularly characteristic of Roumania, still show some influence of the Viennese and Byzantine styles, but the designing, embroidering, and weaving itself show the effort and thought the Roumanian people have given to the development of a national industry. The text is well illustrated with a number of costume designs of the Sarbese, and textile designs of the different provinces of Doljiu, and Arges, and of the Banat. —A. E. G. B.

Analysis of Weaving Designs. C. Marschik. Textilberichte, 1921, **2**, 357.

Examples of patterns produced on the rotary warp loom are described. The twist of the threads in the finished goods appears quite different from that in the design, and only a considerable knowledge of the arrangement of the patterns will enable accurate analyses to be made. —H. R. H.

9.—COMMERCE, ECONOMICS, LABOUR, ORGANISATION, COSTING, &c.

East India Wool: Geneva and the Anthrax Problem. Times Trade Supp., 1921, **9**, 245.

At the discussion at the International Labour Conference at Geneva on wool disinfection with a view to preventing the spread of anthrax, Indian exporting interests were closely concerned. The Indian objections were based upon practical experience of regulations requiring certain classes of wool to be shipped to Liverpool to undergo the process of disinfection before absorption into the market. The classifications adopted have hit the East Indian wool trade with this country very hard, as the most recent trade figures show. An advisory committee is to be set up, consisting of representatives of the principal countries producing and using wool, with a British chairman, to inquire into the question in its humanitarian as well as economic aspects, and this committee is to report to the conference of 1923. —L. M. S.

Czech Artificial Silk Factory in Operation. Women's Wear, N.Y., 1921, **23**, 6.

The first Czecho-Slovak artificial silk factory is said to be complete. The expense of equipment amounted to 30,000,000 crowns; the capacity is 750 kilos daily, to be increased to 1,000 kilos; 450 people are employed. —F. G. P.

Silk Marks defy Doubles in Other Lines. W. Fawcett, Silk, N.Y., 1921, **14**, 50.

An interesting legal decision in America concerning the use by silk manufacturers of trade names or marks already in use in other branches of commerce. It was decided by the U.S. Commissioner of Patents that a brand name used on any dissimilar product may be utilised. Other textile manufactures are not considered dissimilar. —F. G. P.

Cotton-growing and Textiles in Russia. Manchester Guardian Commercial, 1921, **3**, 802.

As was shown at the recent Congress in Tashkent of the United Economic Councils of Turkestan, cotton plantations now cover no more than a fifth of the former area. Out of the 229 nationalised cotton gins only 79 are working, and their productivity is much reduced. As regards cotton-growing some benefit in the form of loans is expected from the new departure, on behalf of the Russian Government, of restoring a State Bank, with its seat in Moscow. The number of cotton spindles, with the secession of Poland, has decreased to 7,000,000. The output of finished textiles in 1920 was 4·5—5% of the pre-war output; that of the woollen mills 30% of pre-war, and that of the flax mills 20 or 25%. In the silk mills the number of hands employed was only one-tenth of the number in 1913. —L. M. S.

Consumption of Wool in Austria. U.S. Commerce Reports, 1921, No.151, 1842.

Statistics are given of the consumption of different grades of wool from April, 1913, to April, 1914, and from April, 1920, to April, 1921. The sources of the wool for spinning and weaving are given, and the manufacture of yarn is dealt with. —L. M. S.

Metric System; Opposition to——. Amer. Silk Jl., 1921, **40**, 48.

The Silk Association of America describes a very vigorous opposition to the proposed introduction of the metric system ten years hence. It is said that as the system is not used in China and Japan, and as sizes of silk are differently expressed, the confusion will be very great and the expense enormous. The average cost to each of 31 firms, it is stated, would be nearly three-quarter of a million dollars for alterations. —F. G. P.

Silk Organzine of Quality. E. R. McElrath. Textiles, 1921, **19**, 31.

Good organzine can be made only from good raw silk, but throwsters can spoil silk and produce poor organzine from good silk. There is some discussion as to whether it is cheaper for a manufacturer to make or buy organzine, tending in this case in favour of the latter method. The author hints that there is an organisation at work with the object of improving thrown silk, and further that even though a large quantity of silk of one brand be obtained it will not all be of the same quality. Mill figures are stated to have shown that it is cheaper to work with high-priced organzine. —F. G. P.

Mill Manager. See *Jl.*, 1921, **12**, 468.

Rome and China: The Ancient Silk Trade. See *Jl.*, 1921, **12**, 467.

10.—MISCELLANEOUS.

Moth-proof Wool. E. Meckbach. Textilberichte, 1921, **2**, 350 and 373.

A preparation named Eulan F. has been produced by a German company. It is an odourless powder, slightly soluble in water. Wool is saturated with a solution of 6 grams Eulan per litre, with the addition of 3 grams concentrated sulphuric acid; in the case of half-wool formic acid is used, and after several hours well rinsed. The wool is not affected, and only a few colours are slightly changed, but may be corrected by after treatment with ammonia. Frequent washing and even slight scouring with soap and tepid water fails to remove the protecting influence. Stronger scouring with warm alkalies has an adverse effect. In one test two tubes were filled with loose wool, one treated with Eulan and the other untreated; 50 moths' eggs were placed in each. After six months the untreated wool had completely disappeared, whereas the Eulan treated wool was intact.—H. R. H.

Diamond Fibre. A. R. R. Jones. Canad. Text Jl., 1921, **38**, 591.

Diamond Fibre, a vulcanised fibre made from paper maker's rag pulp and applicable for the manufacture of loom picks, shuttles, bobbin heads, etc., is described. Its tensile strength is 12,000 to 15,000 lbs. per sq. in.; its shearing strength 10,000 lbs. per sq. in., and its dielectric strength 200-400 volts per mil of thickness. The fibre is specially suited for making textile specialities, as it is entirely free from splinters; it is also used in the manufacture of receptacles of all kinds for the textile industries. —L. M. S.

ABSTRACTS

1.—FIBRES AND THEIR PRODUCTION.

(B)—ANIMAL.

Sericulture in Japan. G. N. Berlet. Text. World Jl., 1921, **60**, 55, 102.

The writer outlines the detail and work involved in the producing of raw silk as practised in Japan. Three silk crops are raised—the Spring, Summer and Autumn. Respectively they form about 50—55%, 5—10%, and 35—40% of the total annual production. —L. M. S.

On the Fleeces of Certain Primitive Species of Sheep. F. A. E. Crew. Ann. App. Biol., 1921, **8**, 164.

The fleeces of certain primitive breeds of sheep have been examined, including Marco Polo's sheep, *Ovis ammon poli*. There are two coats—a summer and winter one. The former is entirely of hair, more or less pigmented. The latter is double, an outer coat of hair similar to the summer coat, and an inner coat of fine curled wool. The characters of the two coats and of the fibres comprising them are described and illustrated in some detail. In the case of *O. orientalis* the fibres of inner (winter) coat does not form a much entangled mass as in the other cases, but forms natural locks very similar in form to those of modern commercial wool. The two kinds of fibres, wool and hair, in these primitive fleeces are quite distinct, and no sort or grade of intermediate fibre was found. It is inferred that fibres of intermediate character found in semi modern fleeces cannot be transitional forms, and the question whether hair and wool are different in origin and development or whether they result from divergent development of a common type of fibre of intermediate character cannot yet be answered. —E. A. F.

Harvest Yields, 1921. Bd. of Trade Jl., 1922, **108**, 24.

According to the International Crop Report for December, published by the International Institute of Agriculture (Rome), the total produce of silk cocoons in Spain, France, Italy and Japan, for countries furnishing almost all the available data as to silk, is estimated for 1921 at 267,000 metric tons in cocoons, as compared with 271,000 in 1920. —L. M. S.

The Skin Temperature of Pachyderms. F. S. Benedict, E. L. Fox, and M. L. Baker. Proc. Nat. Acad. Sci. (from Amer. Jl. Physiol., July, 1921), 1921, **7**, 154-156.

Some relative effects on skin temperature of clothes, natural hair and fur, and the very thick, smooth skins of pachyderms are considered. —E. A. F.

Studies on the Formation of Natural Silk Thread. See Section 6.

Annual Wool Review for 1919-1920. J. B. McPherson. Experiment Sta. Rec. (from Bull. Nat. Assoc. Wool Mfrs., 1920, **50**, 34-115, and 1921, **51**, 29-114), 1921, **45**, 69.

Gives statistics of the domestic wool production and of the wool trade of the U.S.A. and of other countries. —W. R.

Chinese Trade and Economic Notes: China's Wool Industry. U.S. Commerce Reports, 1921, No.192, 853.

Though many varieties of sheep's wool are produced, the wool generally is of poor quality, because the Chinese have not adopted modern scientific methods of breeding and management. Mongolia and Manchuria offer wide fields for the development of the wool industry. Improvements in breeding and management have already been undertaken in Hunan and Manchuria and a cleaning factory established in Tientsin, which has greatly increased the exports. Experiments have been conducted by the South Manchurian Railway Co., and a crossbreed between the merino sheep imported from abroad and the native Mongolian sheep has resulted in a production of wool of twice the quality and quantity on individual sheep. Camel's wool is produced in Mongolia and Chinese Turkestan. Tientsin is the centre of goat's wool production in the northern province, and Ningpo is the market for the Yangtze yield, which, however, is inconsiderable. —L. M. S.

(C)—VEGETABLE.

A Vast Cotton-growing Project. Indian Text. Jl., 1921, **31**, 263.

The *New York Times* published last year an article by Mr. A. Krukman on the reclamation of three million acres of desert land in New Mexico, Arizona, California, Nevada, Colorado, Utah, and Wyoming. It will involve the harnessing of the Colorado River, and it is proposed to build a huge dam at Boulder Canyon to irrigate this vast area, which is the only section of North America suited to the growth of long-staple cotton, such as is now grown in Egypt and the Sudan. —L. M. S.

Microscopic Diagnosis of the Cotton Species. R. Haller. Experiment Sta. Rec. (from Mikroskopische Diagnostik der Baumwollarten), 1921, **45**, 37.

Gives details regarding the identification of individual species of cotton in raw fibre, unfinished yarn, and textiles. Photomicrographs of the upper and lower surfaces of the leaves, of the palisade cells, and of the seed coats of the various species studied are included. —W. R.

Hemp-growing Prospects. Times Trade Supp., 1921, **9**, 305.

The preliminary venture of the Ceylon Hemp and Produce Syndicate in growing sisal has proved successful. The Ceylon Government has just transferred to the syndicate 120 acres of Crown land, adjoining its present hemp estate at Maduruwagama, in the North Central province. The Ceylon Agricultural Society has now taken up the growing of Mauritius hemp, and Rozelle fibre, and reports on the prospects of growing these two plants on a profitable basis will soon be issued. The Imperial Institute has reported upon a sample of Rozelle fibre submitted by the Malaya Agricultural Society that the fibre is quite suitable for spinning either alone or in conjunction with jute. —L. M. S.

Fibres in Fiji: Report of Field Crops Work for 1917-18. C. H. Knowles. Experiment Sta. Rec. (from Fiji Dept. Agric. Ann. Report, 1917 and 1918), 1921, **45**, 34.

Gives results of variety tests with sisal, Mauritius, and manila hemp, kapok, and kawai (*Dioscorea aculeata*). —W. R.

Cotton in South-West Madagascar. H. Jumelle. Bull. Agric. Intell. (from Comptes Rendus des Séances de l'Acad. Agric. France, 1920, **6**, 784-788), 1921, **12**, 71.

Cotton has grown semi-wild or been partially cultivated by natives for a long period, and 15 years ago there were hopes that a successful industry might be established. The so-called native cotton is *Gossypium purpurescens*, but there is also grown a variety simiar, if not identical, with Gujarat cotton, *G. obtusifolium*. This latter variety, it is suggested, is worthy of being submitted to experimental trials with a view to reviving the cultivation of cotton in Madagascar. —W. R.

Cotton Pests. Times Trade Supp., 1921, **9**, 354.

Writing in *Commerce and Finance*, of New York, on the subject of the proposal that the United States should suspend the growth of cotton for one year as a means of destroying the boll weevil and pink bollworm, Mr. P. M. Potts urges that it would be better to divide the south into two zones—an eastern zone, lying east of the Mississippi, and a western zone, to the west of that river. The writer suggests the planting of cotton in the western and eastern zones alternately. One of the objections raised against the prohibition of cotton planting for one year is that many do not believe that one year's prohibition of cotton planting would destroy the weevil, in spite of the claims of the entomologists. The fear has also been expressed that if the weevil could be destroyed the south would produce a crop of 20,000,000 bales of cotton or more in one year, and that this would force down the price of cotton to such a low level that the producers would be ruined.—L. M. S.

Field Manuring Experiments on Nettle. G. Bredemann. Faserforschung, 1921, **1**, 26-32.

Describes a series of manurial experiments on nettles grown for use as a source of fibres. —W. R.

Seed Flax; On the Fibres of Species of—. F. Tobler. Faserforschung, 1921, **1**, 47-62.

Describes studies on the anatomy of the stem of various species of flax grown for the seed. Figures are given illustrating differences in the structure and arrangement of the fibres, and it is suggested that the qualities of seed flax and fibre flax might be united in one variety by crossing. —W. R.

Biological Retting; The Degree and Importance of Acid Formation in——. Gerhard Ruschmann. Faserforschung, 1921, **1**, 31-46.

Discusses the effect of the production of organic acids in the biological retting of flax on the properties of the fibres, and deals especially with the question of artificial driving in this connection and in relation to the strength of the fibres. —W. R.

Handbook of Breeding Agricultural Plants. C. Fruwirth et al. Experiment Sta. Rec., 1921, **45**, 35.

Volume 3 includes matters on the breeding of flax and hemp. —W. R.

Manila Hemp. S. G. Williams. Experiment Sta. Rec. (from Sci. Amer., 1921, 3, 255-7), 1921, **45**, 39.

Describes, with illustrations, primitive methods of obtaining the fibre from the wild *Abaca* in the Philippines. —W. R.

Cotton Dusting in Alabama: Report of Entomologist. W. E. Hinds and F. L. Thomas. Experiment Sta. Rec. (from Alabama Col. Sta. Circ., 1921, No.44), 1921, **45**, 55.

Refers *inter alia* briefly to cotton dusting experiments directed against boll-weevil in 1920. —W. R.

Studies in the Biology of the Mexican Cotton Boll Weevil on Short-staple Upland, Long-staple Upland, and Sea Island Cottons. G. D. Smith. Experiment Sta. Rec. (from U.S. Dept. Agric. Bull., 1921, No.926), 1921, **45**, 59-60.

Reports studies carried out at Madison, Florida, during 1918 and 1919, using varieties King (short staple upland), Webber 49 (long staple upland), and Hope Straight (Sea Island). It is concluded that there is practically no difference between the longevity of boll weevil on Sea Island and Upland cottons, nor is there any difference in the length of the developmental period of the boll weevil on the different varieties.—W. R.

Cotton is not "Cotton": Some Observations on the Character and Staple of the 1921-22 Cotton Crop. D. E. McCuen. Text. World Jl., 1921, **60,** 28.

Under this extraordinary title it is stated that the character of cotton has changed during the past ten years, given areas no longer producing the distinctive qualities they formerly did. Early maturing varieties have become essential, owing to the invasion of the boll weevil. Since 1914 the staple of many cottons has been adversely affected by the poor quality of fertilisers. In practically all sections of the cotton belt this year the cotton is 1/16″ to 1/8″ shorter than last year, and the character is wasty, with a considerable proportion of soft cotton. The strength is no better than eastern belt cotton of the same length, and these factors are stated to be due to adverse climatic conditions. —W. D.

The Irrigation of the Niger Valley and the Culture of Cotton in the Nigerian Sudan. L'Afrique Française, 1921, **31,** Renseignements Coloniaux, No. 10, 217-232.

Discusses the industrial possibilities of the Nigerian Sudan from the point of view of the development of irrigation and the relationship of this to the culture of cotton. The hydrography of the area is dealt with briefly in this connection, and a programme for irrigation work is outlined. Notes on the varieties of cotton suited to the areas are given, it being pointed out that the indigenous cotton is unsuitable for extended cultivation, and although earlier experiments with Egyptian and American species were not very successful without irrigation, the introduction of irrigation should place the industry on a highly successful footing. —W. R.

Historical Note on Experiments with Jute in Bengal. R. S. Finlow. Agric. Jl. India, 1921, **16,** 265-279.

A chronological record of investigations on jute in Bengal. These dealt with races of the two species, *Corchorus capsularis* and *C. olitorius*, and attempts at hybridisation of these, and with the seed supply. Appendices of tabulated results of tests are given. —W. R.

Cambodia Cotton: Its Deterioration and Improvement. G. R. Hilson. Agric. Jl. India, 1921, **16,** 235-243.

The various causes of the changes which have taken place in Cambodia cotton are discussed. They are weakness and staining due to boll worm, and shortness of fibre due to the gradual replacement of better types by poorer ones in the seed mixture. It is then shown how by selection work over three seasons it should be possible to improve the type of plant. The factors involved in the make-up of a heavy yielding type are discussed in some detail. —W. R.

Poisoning the Boll-weevil. W. E. Hinds and F. L. Thomas. Experiment Sta. Rec. (from Alabama Sta. Bull., 1920, No.212), 1921, **45,** 60-61.

Summarises the results of the dusting work during 1920 and earlier years. The work was carried out by a machine using calcium arsenate, and the treatment gave an increased yield of seed cotton corresponding to an increased profit of $16 per acre after deducting the cost of the treatment. It is pointed out that weather conditions always affect the dusting problem. —W. R.

Suggestions for the Improvement of the Warm-water Retting of Flax, with Special Reference to the Questions of Odour and Drying. A. Herzog. Deuts. Faserstoffe (from Text. Forschung, 1921, No.2, 71-85), 1921, **3,** 111-112.

Deals in order with the various features of the bacterial retting of flax in warm water, and shows that by using running water and drying in the open the odour is considerably diminished. The effect of temperature of the water and artificial drying is discussed in relation to over-retting, and it is concluded that the temperature of the water used must lie between 30° and 35°C. to obtain the most favourable results. —W. R.

Agriculture in the Shan States, with Special Reference to "Taungya" Cultivation. E. Thompstone. Agric. Jl. India, 1921, **16,** 251-264.

In "taungya" cultivation jungle fires are made, and then crops such as cotton are grown on the burnt land. The effect of the burning on the fertility of the soil is discussed in relation to Dr. Russel's work on partial sterilisation of soils. —W. R.

Cultivation of Cotton in the Argentine Republic. R. Ronze. Bull. Soc. Ind. Rouen, 1921, **49,** 333.

The area of land suitable for cotton growing in the Argentine is estimated at 500,000 sq. kilometres in the provinces of Corrientes, Catamarca, Jujuy and Santiago del Estero, and 360,000 sq. kilometres in the territories of Chaco, Formosa and Missiones. The latter territories are best suited for cotton growing on account of the climate, rich soil and proximity to railways. The characteristics of the "chaquenne" type of cotton grown in these territories are described, and the prospects for cotton growing in the future are discussed. —L. M. S.

Cotton Pests in West Sudan. F. Zacher. Test. Zeit., 1921, **52,** 523-524.

A short account is given of the chief insect pests which attack cotton in the West Sudan. —J. C. W.

Cotton Sampler. Scientific American, 1921, New Series, 139.

A machine capable of rolling cotton into one-pound packages and covering the rolls with paper is described. —J. C. W.

Disease in Plants. A. Howard. Agric. Jl. India, 1921, **16**, 626-637.
A general article on the relations of weather conditions, and especially soil conditions, to disease in plants. It is shown that the breakdown of immunity to disease is frequently due to soil conditions in their influence on the acidity of the cell sap of the host plants. In connection with wilt diseases of *patwa* (*Hibiscus cannabinus*) and *sanai* (*Crotalaria juncea*) the effect of water logging is traced and graphically indicated by curves showing the relation of disease incidence to rise in the water table in the soil. It is shown that the shallow rooted *Hibiscus sabdariffa* is much less susceptible to wilt than jute and hemp, which have deeper root systems. —W. R.

Controlling Flax Wilt by Seed Selection. E. C. Stackman, H. K. Hayes, O. S. Aamodt, and J. G. Leach. Experiment Sta. Rec. (from Jl. Amer. Soc. Agron., 1919, **2**, 291-8), 1921, **45**, 50.
Shows that it is possible by a seed-plot method of selection to produce good crops of flax on heavily infected flax-sick soil. —W. R.

Jute; Experiments with——in the United Provinces. B. C. Burt and R. S. Finlow. Agric. Jl. India, 1921, **16**, 618-625.
Describes experimental trials with jute in an area known as the *ganjar* in the Sitapur district. In the *terai* jute to be successfully grown requires irrigation, while on typical *kodon* land in the real *ganjar* area jute grew extremely well without any irrigation. Reports are given on samples of the fibre obtained as a result of the experiments, and these are fairly satisfactory. Further experiments are being carried out. —W. R.

Cotton in Syria and Cilicia. E. L. Achard. Rev. Text., 1921, **19**, 1759-1766.
In a report presented by the Marseilles Chamber of Commerce the climatic suitability of Cilicia for cotton growing is indicated, and statistics are given of the production of cotton there since 1896. The temperature, rainfall, hygrometry, winds, and the amount of evaporation are dealt with in seriatim, and the special features of each in regard to Cilicia pointed out. Considerable space is devoted to a description of the topography and of the soils in the chief districts, including the eastern and western plains of Cilicia and the natural irrigation by rivers is described. The programme of developmental work previously proposed by a German company in regard to cotton growing is outlined, and this includes credit facilities to the growers, technical instruction and advice. The results obtained from the tour of inspection described in this report are finally summarised, and the programme and work of the Deutsch-Levantinische Baumwoll-Gesellschaft severely criticised, and the substitution of France for Germany in Cilicia discussed briefly. —W. R.

Observations on the Wilt Disease of Cotton in the Central Provinces of India. S. L. Ajrekar and D. V. Bal. Agric. Jl. India, 1921, **16**, 598-617.
Wilting of cotton is due to two distinct causes:—An insect (stem borer, *Sphenoptera gossypii*) and a fungus, a *Fusarium* not identical with *Fusarium vasinfectum* which causes cotton wilt in America. The damage due to this disease is estimated, and previous work briefly summarised. The present work was concerned with the study of the fungus and the conditions of the soil and host which favour or retard its growth. The reported immunity of *buri* cotton was tested by inoculation and confirmed. Two strains of *Fusarium* capable of causing wilt were isolated. These fungi produce in culture sclerotium like bodies which differ in colour in the two strains. Experiments to test if wilting is due to the excretion of toxins by the fungus gave negative results. Different methods of possible control are briefly discussed. —W. R.

Cotton Cultivation in Nigeria. T. Ruete. West Africa, Nov. 5, 1921.
Cotton has long been grown in Nigeria, but the native product does not sell readily, owing to its roughness and brownish tint. Efforts are being made to develop the industry and to supplement native cotton by that grown from long-stapled American seed. Large tracts of land are particularly suitable for cotton growing, both as regards soil and climate, but additional transport facilities are needed. —J. C. W.

Coloured Cotton. Indian Text. Jl., 1921, **32**, 48.
Mr. A. W. Brabham, of South Carolina, claims to have produced coloured cotton of fine fibre. He has exhibited four samples of cotton in natural colours on the Savannah Cotton Exchange. These samples shaded from light to dark green and from light to dark brown, the latter being a particularly fine, soft fibre. It is stated that in India cotton is grown naturally in various colours, particularly blue, grey, and light pink shades. In Peru cotton also grows naturally in colours. From his last crop Mr. Brabham is convinced of the possibility of raising black cotton. —L. M. S.

Korea: Cultivation and Export of Cotton. Bd. of Trade Jl., 1921, **107**, 493.
According to the "Official Gazette" the area of germinated cotton in the ten provinces amounts to 362,550 acres, of which 263,802 acres are planted with upland cotton and 98,748 acres with native cotton. The area devoted to foreign cotton has steadily increased since 1912. Practically the whole of the cotton exported goes to Japan. A cotton industry is being developed in Korea, but up to the present it has not been able to supply any considerable proportion of the home demand for manufactured goods, Japan being the principal source of supply. —F. C.

China; Notes from——. Cotton, U.S.A., 1921, **86**, 30.

There is a promising cotton belt in Honan between Shenshsian and Lingpaohsien. A smaller amount of cotton is grown from American seed, the product being longer and finer than the native product. The annual yield of native cotton is about 1,200 tons. What is not used locally is sold in Hankow and Tientsin. —J. C. W.

Chlorine-Dioxide Solution; Application of——. See Section 6.

(D)—ARTIFICIAL.

Viscose Silk Precipitating Baths. H. Walter. Deut. Faserstoffe, 1921, **3**, 121-124.

A discussion of the merits of various precipitating baths for cellulose xanthate. Sulphuric acid is the commonest ingredient, but the addition of metallic sulphates is beneficial. Ammonium and alkali sulphates are commonly used, and zinc and magnesium sulphates have been recommended to prevent deterioration of the bath. Glucose is also frequently added. Two recent patents are reviewed, in which vegetable products are added to a sulphuric acid bath containing no salts. One employs residual sulphite liquors from cellulose factories and the other an extract of pine needles. The artificial silks spun from such baths are said to be almost indistinguishable from natural silk. —J. C. W.

Artificial Silk. Papierfabrikant, 1921, **19**, 1,398.

At a Conference of the Association of Cellulose and Paper Chemists and Engineers, Dr. W. Vieweg, discussing the production of artificial silk, states that a cellulose rich in cellulose is the best form of raw material. In the discussion it is stated that the chief factors affecting the suitability of cellulose for the manufacture of artificial silk are the nature of the wood, its treatment, and non-cellulose content. Dr. Klemm states that a microchemical examination of the absorptive power of a cellulose for malachite-green and rosamiline sulphate, and especially an examination of the corrosion changes with Congo-red and zinc chloro-iodide, afford a simple means of recognising the suitability of a cellulose for the manufacture of artificial silk. —J. C. W.

PATENTS.

Pulling Flax. W. H. Smith, Bath. E.P. 171,239, Nov. 17, 1921. (Appl. No. 25,992/20.)

The machine comprises one or more sets of grippers mounted in rotary frames arranged on the platform of a sheaf binding reaper or other machine. The gripper frames are mounted in an inclined frame attached to the platform frame of the reaper in place of the cutting apparatus. They are driven from a shaft by bevel gearing and inclined spindles. V-shaped grippers move in slots in the gripper frames and in radial projections of same under the control of springs. The flax is guided to the grippers by single and double guides, the latter forming abutments against which the flax is pressed by the grippers. It is delivered on to a travelling platform by guides and conveyor belts. —T. W.

Apparatus for Decorticating Fibrous Plants. Frank O'Neill, Jnr., Philadelphia. U.S.P.1,393,819, Oct. 18, 1921. Appl. 8/12/16. Renewed 7/3/21. (7 claims: 2 printed.)

The machine has in combination rolls arranged in two series with the rolls of one series opposite the spaces between the rolls of the other series, said rolls acting to flatten the plants, and plant bending instrumentalities to which the plants are delivered endwise from said flattening rolls and which comprise rolls and blades situated opposite the spaces between adjacent rolls, and the protuberant bending surfaces of successive blades being faced in opposite directions, said rolls being progressively onward driven at increasing speeds whereby the plants are subjected to a tensile or pulling action. —T. W.

Seed Cotton Cleaner. Charles C. Biggerstaff, Rowesville, S.C. U.S.P.1,395,382, Nov. 1, 1921. Appl. 22/5/20. (6 claims: 4 printed.)

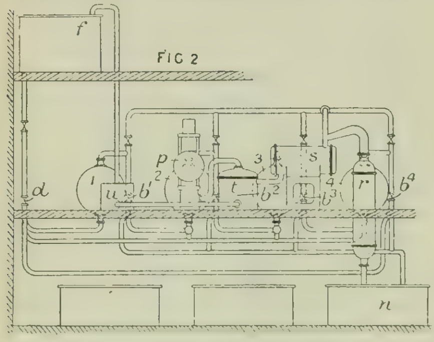
The device consists of a conduit having means connected thereto for creating a pneumatic suction therein, of a baffle having perforations located in the conduit adjacent its inlet end, said baffle plate having an extension plate arranged at an inclination relative to the longitudinal plane of the conduit, to retain the trash and dust that may pass through the perforations of the baffle, means below the extension plate radially in line with the baffle for agitating the seed cotton after being deflected and initially broken by the baffle, a chute carried by the conduit adjacent said means, pneumatic suction means connected to the chute for drawing off the trash and dust therefrom, means arranged in the chute adjacent where said pneumatic means is connected thereto, for drawing the trash and dust into said pneumatic means, said chute having an extension to which a receptacle may be connected for receiving rocks and gravel, said extension having a valve for controlling the discharge of the rocks and gravel into the receptacle. —T. W.

Viscose Solution; Preparation of——. C. L. Stulemeyer. Niederl. Pat., Class 29C, 13,798. Leipzig Monatschr. Text. Ind., 1921, **36**, 196.

Cotton is rendered thoroughly permeable to alkali by evacuation, and is mixed with the lye in this condition. The solution obtained is more easily filtered.—J. C. W.

Treating Wool. Sir T. A. Coghlan, London. E.P.170,645, Oct. 21, 1921. (Appl. No. 21,902/20.)

Wool is cleaned by first heating it at a temperature of 45°C. or below with trichlorethylene, and then removing the residual trichlorethylene by a current of carbon dioxide which may be bubbled through oil and then used again, or by washing with water at about 45°C., the water being subsequently treated for recovery of potash salts. The apparatus described has a series of connected vessels 1, 2, 3, 4, each communicating by pipes with a storage tank *f*, an exhaust tank or still *n*, and a vacuum pump *p*. Each vessel can receive fresh wool, be evacuated, and be supplied with fresh trichlorethylene, in any order, whilst trichlorethylene after acting in one vessel can be moved to another vessel under the pressure of its own vapour, valves *d*, b^1, b^2, b^3 and b^4 being operated for these purposes. The vacuum pump *p* also serves for distilling the spent solvent containing dissolved wool grease in the still *n* through a distillation column *r* and condenser *s* into a receiver *t*, whence the trichlorethylene is raised by a pump *u* to the storage tank *f*. The wool cages run on rails near the vessels 1, 2, 3, 4. —T. W.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Cotton Stalk Puller. Thomas H. Monk, Tallahasse, Fla. U.S.P.1,393,955, Oct. 18, 1921. Appl. 25/9/20. (1 claim: 1 printed.)

The puller includes a handle, a stalk embracing member consisting of a strap, one end of which is countersunk in the handle and detachably connected thereto, the other end of the strap being bent acutely to provide a substantially V-shaped structure for engaging with the stalk. —T. W.

Fibrous Materials. P. J. White, Bangor, Carnarvon. E.P.170,869, Oct. 24, 1921. (Appl. No. 11,415/20.)

A fibrous absorbent product is obtained from zoophytic or polyzooic material found on the sea shore. After being washed, separated from seaweed, and treated with dilute acid a product is formed capable of being used as stuffing material, while the inner filament is dissolved in alkalis and prepared to be used as a surgical dressing or the like. —T. W.

Preparation of Cellulose or Pulp. W. Raitt, London. E.P.171,482, Nov. 16, 1921. (Appl. No. 23,864/20.)

Relates to improvements in the processes and apparatus described in Spec. 15,779/12 and 16,488/15 for the isolation and extraction of cellulose or paper pulp from fibrous materials, such as bamboo, grass, straw, reeds, jute, etc., in which the non-cellulose parts of the materials are removed in separate groups, and consists in carrying out both operations on a charge of material in the same vessel or digester, the vessel being used as a single unit, or several vessels being combined as a battery working in series. The liquor from the second digestion is separated from the pulp during the discharge of the contents of the digester, and is delivered to another digester in which the charge of raw material acts as a trap or filter to arrest any pulp carried over with the liquor. The pulp is transferred to one or more diffusers, where the bleaching or washing is effected by passing the washing liquor through a number of diffusers in series, the pulp in each diffuser being first washed with liquor which has been passed through the other diffuser, each diffuser being advanced after each washing until finally it is treated with fresh water. —T. W.

Cotton Cleaning and Separating Machine. John E. Mitchell, St. Louis, Mo. U.S.P.1,395,054, Oct. 25, 1921. Appl. 17/1/21. (4 claims: 3 printed.)

The machine comprises a saw cylinder, an upper and a lower hull board co-operating therewith, and the lower edge of each of which defines the size of an opening past the saw cylinder, and means operating to lower the upper hull board away from the saw cylinder to discharge accumulated products upon the lower hull board while the latter hull board is maintained in a normal operative position, and then to return the upper hull board to normal position and to move lower hull board to a discharge position, said means operating continuously to effect the alternate movements of the hull boards. —T. W.

Preparing Fibres for Spinning: Scutching Apparatus; Heckling Machines; Holders for Flax, etc. C. Decuypère and M. G. Dujardin, both of Belgium. E.P.171,111. (Appl. No. 29,449/21.) Conv. Nov. 5, 1920.

Flax is spread in nips comprising two metal strips doubly hinged at one end and provided with a catch at the other, and the nip is placed on a stand. Holders attached to vertical endless chains are arranged to pick up the flax in the nip and carry it between a number of pairs of scutching devices which open to let the holders pass, and then close to operate as desired upon the material. At the beginning of the descent the holder is opened, the flax drawn partly through, and the nip removed. The flax is then treated by a second series of devices. At the bottom of the descent, the holder is opened and the flax is withdrawn. The scutching devices may be replaced by hackling devices. The number of scutching devices may be varied, and three only may be used, the one in the middle being fixed and the two outer ones being moved towards and from it as necessary. -T. W.

Flax Pulling Machine. Georges Michot, Dromara, Ireland, Assr. to The Fibre Corporation, Ltd., London, England. U.S.P.1,393,951, Oct. 18, 1921. Appl. 18/4/18. (3 claims: 1 and 3 printed.)
The machine comprises a frame supported on tractor wheels, a horizontal axial shaft extending across the machine on which said wheels are rigidly secured, a U-shaped frame pivotally mounted at one end of the axial shaft, a second motion shaft supported at one end in a bearing in the U frame and at the opposite end by a bearing piece parallel to the axial shaft, gear wheels secured at each end of said second motion shaft in mesh with gear wheels secured on axial shaft, a third motion shaft mounted in bearings in upper part of the U frame with a gear wheel mounted thereon in mesh with the said gearing to convey motion through a clutch and gear wheel in mesh with a spur pinion attached to drum casing provided with slotted openings and guide bars, said drum mounted on a horizontal shaft, the central part of which is cranked, a series of combs loosely mounted thereon which engage slotted guide bars in drum, whereby the drum and the combs receive a differential movement when rotated. —T. W.

Cotton Harvester. George S. Knox, Wilkinsburg, Pa. U.S.P.1,395,644, Nov. 1, 1921. Appl. 28/9/17. (10 claims: 1 and 6 printed.)
A collecting machine has, in combination, a pair of tanks, an air impelling device and a collecting pipe, valve mechanism for controlling the operative connection of said device and of said pipe to said tanks, and means for controlling said valve mechanism, means for actuating a current of air through the tanks and means for selectively controlling the operative connection of said actuating means to the one or the other of said tanks. —T. W.

2.—CONVERSION OF FIBRES INTO FINISHED YARNS.

(A)—PREPARATORY PROCESSES.

Model Cotton Machines. Leipzig. Monatschr. Text. Ind., 1921, **36**, 239-240.
A model opener, carding engine, and felting machine for the preparation of good samples from loose fibre are described. The machines are manufactured by a Chemnitz firm. —J. C. W.

(B)—SPINNING AND DOUBLING.

Tension of the Yarn on Ring Frames; Study on the——. Rev. Text., 1921, **19**, 1,449.
Minute calculations are given showing the various forces acting on the yarn as it passes from the delivery rollers through the thread guide and traveller, also during winding on to the bobbin. —A. H. M.

Long Drafts in Cotton Spinning. C. L. Alexandre. Rev. Text., 1921, **19**, 1,461.
In continuation of the previous article (*Jl.*, 1921, **12**, 392) the question of pressure on the rollers is dealt with. The amount of pressure exerted by the rollers is of great importance; it must be light enough to allow the fibres to slide and strong enough to regulate the speed of flow. The greater the draft the lighter the pressure exerted must be. When the draft is increased the pitch of the roller must be made smaller; when heavier sliver is put through the pitch must be increased. For mills working classes of cotton which are very different the use of two kinds of pressure weights is recommended. The pressure varies from 60—120 grams for two spindles against 1,200—2,500 grams in the ordinary system. In this long draft system the minimum of twist must be given to the rove. Any mill drafting by the ordinary system satisfactorily can easily change over to the long draft one. The practical drafts realised for different cottons are stated. Tables are given showing that the yarn produced by the long draft method is much stronger, more regular, and more elastic. Mills adopting this method do well to keep their roving frames for numbers higher than 24's: some could, with this method, run their spinning room with two shifts of 8 hours while running the preparing with only one shift of 8 hours. —A. A. M.

Mule Drive. L'Ind. Text., 1921, **37**, 457.
A description of a new drive which ensures shockless starting of the cylinders and the carriage, and by maintaining constant torsion permits spinning to take place under the best conditions. Two diagrams illustrating the action of the drive are reproduced. —J. C. W.

The Inter-relation of Mercerisation and Spinning. See Section 4H.

(D)—YARNS AND CORDS.

Heather Mixes in Yarns and Fabrics. Text. World Jl., 1921, **60**, 39.
Formerly these mixtures were obtained from dyed yarns, either single or double yarns being used. Highly-coloured yarns were as a rule doubled or twisted with plain colour or shade—generally black, so as to tone down the loudness of the colours. The method invariably employed for knitting yarns is to use the dyed wool 15% of colour along with 85% of dark colour, also 15% of white when blended with a plain dark colour, and 5% white

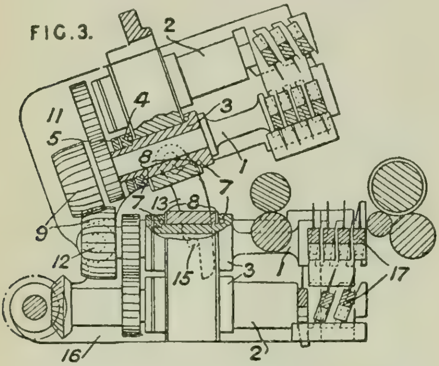
along with 15% fancy colour. It is recommended to make experiments in new heather mixtures with the use of hand cards, weighing out the various colours in their due proportions. —W. D.

PATENTS.

Preparing Fibres for Spinning: Gill Boxes. H. Grivel, Alsace, France. E.P.171,351. (Appl. No. 8,258/21.) Conv. Nov. 10, 1920.

In gill boxes with a single set of fallers or a double set of intersecting fallers, the operating screws 1, 2 are provided with ball-bearings 3, and in arrangements in which the upper set of fallers is mounted in a pivoted frame 11 so that it can be raised to allow of the removal of the lower fallers 17, the intermeshing driving pinions 9 are provided with convex faces. The frame 11 is pivoted at 12 on the frame 16, and is provided with a prop 13 adapted to engage a stud 15. The ball bearings comprise two sets of balls 7 engaging plates 8 and adjusted by nuts, 4, 5.—T. W.

FIG. 3.



Knot-tying Devices. W. Coombes and F. W. Pare, both of Nottingham. E.P. 170,370, Oct. 17, 1921. (Appl. No. 21,454/20.)

Relates to a knot-tying device of the kind described in Spec. 18,778/00 or 2,311/03, where a spring returns the actuating lever after being released to its upper position in readiness for the next operation. A buffer plate provides a stop for this return movement. The knotter is mounted upon a holder secured upon a bar by means of a saddle plate and a thumb screw. A guard protects the operator. —T. W.

Artificial Silk, etc. E. Bronnert, Mulhouse, France. E.P.170,608, Oct. 24, 1921. (Appl. No. 11,362/20.)

Cellulose hydrate is dried by a strong current of air or neutral gas of a minimum velocity of 3 metres per sec. and at 100—140°C. The drying passages of the tanks are divided by transverse vertical partitions or by perforated partitions, the spaces between them being the heating chambers. Provision is made for thorough mixing of the material and air. —T. W.

Spindles. T. M. Prudden, Massachusetts. E.P.170,473, Oct. 27, 1921. (Appl. No. 25,882/20.)

The upper bearing of a spindle is in the plane of the driving whorl, the outer ball race fits freely into a recess in the upper end of the bolster, and is retained by a screwed adjusting ring sealed or locked by a set-screw. Thin hardened rings are forced against the ball races to form wearing surfaces. An extension of the ring enters a recess in the whorl to clamp the ring upon the spindle. The lower ball bearing is cushioned laterally by leather or the like or by spring fingers formed on a cup member. Fibrous packing material may also be placed between the screw threads of the bolster and a split supporting collar. Oil filling and removing plugs are provided. —T. W.

Thread-tensioning Devices. H. Meynell, Accrington. E.P.170,775, Nov. 3, 1921. (Appl. No. 33,385/20.)

Yarns in textile machines, such as winders, doubler winders, hosiery frames, &c., are tensioned by ball-drag devices held down by the caps of holders provided with narrow stems and made of porcelain. Wooden or other screws pass through countersunk or other holes and through larger circular or other apertures of the caps and fasten the holders to the bar or carrier. The considerable space between the holders and the ball-drag devices minimises the collection of fluff, &c. Round-headed screws may be used, and leather or rubber washers may be interposed between the caps and the screw-heads. The stem of the cap may be of square or polygonal form. —T. W.

Singeing Threads. Soc. Anon. Electro-Textile, Paris. E.P.170,849. (Appl. No. 28,223/21.) Conv. Oct. 28, 1920.

An electrically heated burner for singeing threads is provided with a metal band connected to the terminals and maintained at a constant distance from the thread to be singed by a quartz or other gutter which cannot be deformed by heat. The burner illustrated comprises brass shell fitted with a layer of asbestos, then a heat-accumulating mass and an electrically-heated band disposed between the quartz gutters. —T. W.

Polishing Twine, etc. F. Scheibe, Chemnitz, Germany. E.P.170,865. (Appl. No. 28,870/21.) Conv. Oct. 30, 1920.

Twine is polished when winding from skein to bobbin, the yarn passing through a dressing trough and a stripping device, several times round drums adapted to keep the convolutions separate, and then to a spool. Polishing brushes act on both sides of the sheets of threads between the drums and revolve in opposite directions to those of the threads. Several devices are arranged on one machine so that the breakage of one thread does not stop the machine. —T. W.

Spinning: Spindle-driving Apparatus; Spindle Apparatus. W. H. Waite, J. W. Worsnop, E. Priestley, and N. H. Robinson, all of Leeds. E.P.171,138, Nov. 8, 1921. (Appl. No. 19,401/20.)

In cap spinning, doubling, twisting, and like frames wherein friction driving cones engage cones fixed on the tubes, coned discs drive pulleys on the tubes and are splined on vertical shafts mounted in bearings behind the spindles. The pulleys are provided with a cavity, closed by a spring-pressed spherical valve for lubricant for the spindle and tube. In the Provisional Spec. it is stated that the invention is applicable to the spindles of ring and flyer frames. —T. W.

Combing Machines. D. H. Binns, J. D. Mander, and W. Binns, all of Bingley. E.P.171,141, Nov. 17, 1921. (Appl. No. 21,836/20.)

In a dabbing brush arrangement two brushes, or a brush and a dummy, are mounted on parallel spindles and are driven from a common element so that one is at the top of its traverse while the other is at the bottom, the driving-element is a cam-slot or face-cam rotating about an axis parallel to the spindles. The brushes are mounted on spindles carrying guide-blocks with pins engaging a cam slot. The cam is mounted on a shaft parallel with the spindles and is driven by worm gearing. —T. W.

Carding Engines. R. T. Comer, Georgia, U.S.A. E.P.171,188, Nov. 14, 1921. (Appl. No. 23,735/20.)

A moving clearer for travelling flats co-operatives with the stripping comb and removes the strippings from it and transfers them to a receiver. The clearer is raised to move over the stripper in its forward stoke, while on the return stroke the clearer moves under a pivoted switch in contact with the stripper to remove the strippings and transfer them to the receiver. —T. W.

Spinning: Processes; Fibres, Sorting and Stapling. F. D. S. Sandeman, Dundee. E.P.171,602, Nov. 24, 1921. (Appl. No. 30,041/20.)

As jute and similar fibrous material is passing from the bale opener it is cut into lengths not greater than 2ft. and not less than 8 in. in length, by means such as those described in Spec. 120,300. The short lengths are then delivered automatically to a hopper feed apparatus, and transferred in blanket form to the softener. From the softener it is delivered by a conveyor to the barrows, and after being conditioned therein is fed by hand to a hopper feed mechanism which passes it to a breaker card. The fibres issuing from the cutting-machine on conveyor bands may be sorted and graded in accordance with the portion of the stalk from which they are taken. —T. W.

Spinning. J. W. Morrison and T. Holt, both of Stalybridge. E.P.171,215, Nov. 17, 1921. (24,507/20.)

The tube or other support on which the yarn is wound in doubling, twisting, winding and like machines, *e.g.* doubling frames wherein the yarn is drawn from a package mounted on a spindle rotating at high speed and is wound on a tube rotated by a drum, is pressed against the driving drum by a main and an auxiliary weighting-device, the effect of the latter being diminished as the cheese or the like is built up. —T. W.

Spinning: Spindle Rails; Spindle-driving Apparatus; Stop Apparatus, Non-automatic. J. C. Leslie, Dundee. E.P. 171,274, Nov. 17, 1921. (Appl. No. 27,690/20.)

Spinning spindles terminate just below the neck rail, are without footstep, and are driven by discs splined on a horizontal shaft and are normally pressed against a disc on the bottom of the spindle. The spindle rail is in the shape of a box, and short axles which project through the front plate carry a rectangular plate by which the axle is turned by a handle conveniently placed for the spinner. The horizontal shaft may be in sections so that a limited number of spindles are out of gear when repairs are required. Spec. 20331/09 is referred to. —T. W.

Guards for Lap-forming Machines. Platt Bros. and Co., Ltd., and I. Leech, both of Oldham. E.P.171,277, Nov. 17, 1921. (Appl. No. 27,864/20.)

A guard for Derby doublers, comber doublers, and like lap-forming machines comprises a door, which may have a grid or wire-mesh front, pivoted on a cross shaft and provided with a lever or member having a straight slot terminating in a curved slot in which engages a stud on a bracket carried by the rack-bars supporting the weighting roller. As the lap forms, the stud rises, but holds the door closed while still in the straight slot. When the lap is completed the machine is automatically stopped, and the rack bars are then further raised manually, thus causing the stud to enter the curved slot and open the guard. Two arrangements are mentioned. —T. W.

Thread Guide of Spinning, Twisting, Doubling and like Frame. George F. Bull, Birmingham, Assr. of one-half to Charles H. Pugh. U.S.P.1,392,743, Oct. 4, 1921. Appl. 10/7/20. (3 claims: 1 printed.)

Thread-guide lappers for spinning, twisting, doubling and like frames comprise a thread guide wire formed with a worm rack engaged by a rotatable worm by which the guide wire can be adjusted longitudinally, of a spring which exerts a lateral pressure upon the worm in order to retain the guide wire in its adjusted position. —T. W.

Spinning: Mules. T. H. Cordingley and A. Burgess, both of Rochdale. E.P. 171,261, Nov. 17, 1921. (Appl. No. 26,863/20.)

When the scroll band has a reserve length which can be utilized when the band breaks near the scroll pulley, the band is temporarily fastened to the carriage by a device comprising a bracket with a cross stud and a wedge with sharp pegs. —T. W.

Device for Guiding, Clearing, and Tensioning Yarn. John O. McKean, Westfield, Mass., Assr. to Foster Machine Co. U.S.P.1,392,515, Oct. 4, 1921. Appl. 12/4/21. (14 claims: 2 printed.)

A tension device has a removable and reversible grid forming a skeleton yarn support, a gravity operated disc normally resting on said support and having an axially arranged depending lug projecting between the branches of the grid, and guiding means for causing the yarn to contact with the said lug. —T. W.

Thread Tensioning Means. Louis Veilleux, Philip H. Leveque, and Joseph Barnes, New Bedford, Mass. U.S.P.1,393,926, Oct. 18, 1921. Appl. 30/9/20. (4 claims: 3 printed.)

The device comprises a bracket including means for supporting the bobbin and a head over which the thread passes, the latter being provided with a thread-guide, a weighted arm pivotally mounted on said head having a portion extending transversely across the latter, and a friction shoe pivotally mounted on said transverse portion of the arm, a piece of resilient metal secured at one of its ends to the shoe, being spaced from the latter and independently movable with respect thereto. —T. W.

Spindle. Edward A. Cunniff, Fall River, Mass., Assr. to Draper Corporation. U.S.P.1,394,668, Oct. 25, 1921. Appl. 4/3/20. (4 claims: 4 printed.)

A whirl for vertical spindles has an annular V-shaped groove for a driving band, the lower wall of said groove being provided with a cam having its end extending in the direction of rotation of said whirl and adapted to engage a sagging driving band and ship the same from the whirl. —T. W.

Top Screw for Gill-drawing Frames. Willie Holdsworth, Providence, R.I. U.S.P.1,394,829, Oct. 25, 1921. Appl. 23/5/21. (2 claims: 2 printed.)

In combination with the end bearing member of a gill-drawing frame is a top screw having screw threads on its exterior and a stud projecting from its end, a faller cam mounted on said stud to adapt it to turn with the screw, and an enlarged collar screwed on to the end of the stud to secure the cam against the end of the screw, said collar adapted to be received within a bore in the bearing member to adapt the screw to turn therein. —T. W.

Balling Machine. Alexander Groundwater Walls, Paisley, Scotland, Assr. to Walter McGee and Son, Ltd. U.S.P. 1,395,213, Oct. 25, 1921. Appl. 11/2/16. (1 claim: 1 printed.)

The machine comprises a bobbin carrier sustaining a bobbin from which the yarn is unwound, of a drag shoe active on the yarn during the unwinding operation to apply tension to the yarn in opposition to the unwinding movement, a normally inoperative brake lever, and means operative on the knocking off of the machine for causing said brake lever to engage said drag shoe, whereby the drag shoe is caused to bear with increased pressure on the yarn to arrest the bobbin.—T. W.

Thread Spinning Machine. William B. Conyngham, Wilkes-Barre, Pa. U.S.P. 1,395,223, Oct. 25, 1921. Appl. 27/10/20. (21 claims: 6 printed.)

Relates to a combination with the feed shaft of a thread spinning machine having a spinning unit drive gear thereon of a fixed shield arranged adjacent the shaft and a thread cutter carried by said shield to cut the thread on its attempt to wind about the shaft. —T. W.

Stop Motion for Doubling Frames. William Scott, Rochdale, England. U.S.P.1,395,529, Nov. 1, 1921. Appl. 20/5/20. (1 claim: 1 printed.)

A hand operated stop motion for the spindles of a doubling frame comprises a rabbeth self-contained spindle, a friction driving cone and a driven cone member thereon, a vertically sliding rod placed adjacent to the spindle, a bracket to support the rod and within which it slides, a bracket on the lower end of the rod, a friction brake plate affixed to the lower bracket to embrace the driving cone on the spindle, and when raised to engage the driven cone member, a bracket on the upper end of the sliding rod adapted to carry the top roller of the machine, a hand lever pivoted to the bracket on the sliding rod and a fulcrum on the handle resting on the supporting bracket, all so disposed that on raising the handle the sliding rod is raised and with it the top roller and the driven cone member, and at the same time the rotation of the latter retarded and stopped. —T. W.

Improvements in Heilmann Combing Machines. J. Jolly. F.P.514,736. Appl. 22/4/20.

This patent refers to a head of Heilmann combing-machine containing an oscillating frame supporting the acting organs of the machine. This frame can be separated from the neighbouring heads and be carried away or replaced. This frame also supports a clasp-plate fixed to the frame, a mouth of clasp, a superior comb, a feeding roller mounted on the comb, a cam and a level for moving the oscillating frame and a fixed cam with incurved rim in order to move the other organs. —Bur. Text.

Carding Engine. Edward Tillotson, Rochdale, England, Assr. to Potter's Asbestos Co. U.S.P.1,395,877, Nov. 1, 1921. Appl. 20/12/18. (1 claim: 1 printed.)

An apparatus for mixing and carding fibrous materials in combination with a carding cylinder comprises a licker-in roller operatively associated with the carding cylinder, sets of feed rollers arranged at different points adjacent the periphery of said licker-in roller, means for passing a lap to one set of feed rollers, mechanism for passing loose fibres of different material from said lap to another set of feed rollers, whereby said lap and fibrous material are fed simultaneously to different points on the periphery of said licker-in roller and the mixed material is taken from the licker-in roller on to the carding cylinder at a single point on the periphery thereof. —T. W.

3.—CONVERSION OF YARNS INTO FABRICS.

(B)—SIZING.

Yarn; Streaky Sizing of——. Textil-Zeitung, 1921, **52**, 431.

Streaks in the yarn may be due to (*a*) the separation of objectionable materials in the size on the yarn, (*b*) deterioration of the felt on the rollers, whereby the excess of size is unevenly expressed, (*c*) unequal loading of the rollers, (*d*) contamination of the felt by incrusted material from previous operations, (*e*) stopping of the machine. —J. C. W.

Weavers' Discussion at Greenville: Slashing. Cotton, U.S.A., 1921, **86**, 6-12.

A conference and discussion on sizing dealt with the influence in sizing of the percentage of starch, the temperature and the time of cooking the size. The time of cooking affects the amount of size left on the warp. Breaking strength of the warp is greater the lower the temperature of the size, but this effect varies for different counts. The breaking strength also increases with the time of cooking the size. Shedding is not so great if the size has been cooked for a long time. The method of putting tapes on the beams before tying-in, the effect of double and twisted selvage on production, and the necessity for experiments on the percentage of water left in yarn after sizing are discussed. The effect of "cover" or "face" on cloth depends not only on the loom settings, but on the elasticity of the sized warp. —J. C. W.

(C)—WEAVING.

Filter Cloth. A. Wright. Jl. Ind. Eng. Chem., 1921, **13**, 984-986.

A general discussion of the selection, properties, and use of industrial filter media. The relative merits of duck, chain and twill weaves are reviewed. —J. C. W.

Weaving the Van Heusen Collar. S. Brown. Text. World Jl., 1921, **60**, 35.

The Van Heusen collar is made to the shape on a loom designed for the purpose, ready to be cut into suitable lengths. Clumsy joins are thus avoided, and much labour in making and cutting is saved. The formation of the cloth is such as to allow greater length at the outer edge of the collar than the band, and to produce this a heavy loom is required of sufficient strength and beat-up of the lay for packing in the weft where 1,000lbs. for each individual piece must be carried. The looms at present in use have from 12 to 16 pieces, so that in getting the requisite shed opening the strain on the cams is specially severe. The long-sided formation of the cloth is produced by cone-shaped take-up rolls, the roll having a slope of one in 6in. Above this cone-shaped roll is hung a straight roll which swings freely to different angles so as to take up the slack delivered to the take-up roll. —W. D.

Hand-loom Weaving in India; A Note on——. K. S. Rao. Jl. Indian Industries and Labour, 1921, **1**, 470.

The following conclusions are drawn:—The total consumption of clothing in India is likely, in the near future, to be 5,000 million yards of coarse cloth per annum, besides the finer qualities which have to be imported to the extent of 2,500 million yards; only half of the former quality is now produced in the country, 1,500 million yards by the mills and 1,000 million yards by the cottage weaver. The general belief that hand-woven goods cannot compete with machine-made goods is erroneous: the number of spinning mills in India ought to be doubled rather than a large number of weaving mills started; a vigorous policy for the rapid and satisfactory development of hand weaving should be pursued on the lines recommended by the Indian Industrial Commission, and some notes are appended as an elaboration of the recommendations of this Commission. —L. M. S.

Future Development of the Power Loom. See *Jl.* Proc., 1922, **13**, 9.

(D)—KNITTING.

Milanese Machine; The——. J. Watel. Textiles (from Le Moniteur de la Maille), 1921, **19**, 43.

The products of this machine have not developed greatly during the past ten years, owing chiefly to the very elaborate nature of the mechanism required for this fabric and the skill essential in making the machines. The fabric produced is termed traverse where two sets of plain knitted fabric are superimposed on each other, one having its stitches moving gradually to the right and another with its stitches moving towards the left. —W. D

Improved Knitting Machine. Textiles, 1921, **19**, 31.

At present splicing yarn can only be introduced in a circular fabric with a reciprocating motion of the machine, and when the splicing is cut it leaves an unsightly end of cut or broken yarn. By this improvement reinforced fabrics are produced with definite margins by the introduction of web holders which cut the thread at the desired point. —W. D.

Automatic Stopping Device. Textiles, 1921, **19**, 21.

This device has been added to a circular knitting machine to stop the frame when a hole occurs in the fabric. The principle of the motion is to have a finger or pin which presses against the tubular fabric as it passes round. When a hole occurs in the fabric this pin enters the hole, thereby connecting with the lever which stops the machine. —W. D.

(G)—FABRICS.

Thibets. Amer. Wool and Cotton Reporter, 1921, **35**, 2,905.

The characteristics of thibets are a firm but flexible handle, a short thick nap, and a plain pattern with no feature of weave or texture in evidence. The cloth is sett comparatively wide in the loom, and the composition of one style of this fabric is given as follows : 60% of white medium quality wool, 40% white re-worked wool, carded and spun into 3½ run yarn with a right-hand twist. There are 2,640 warp threads and 40 picks per inch of weft spun to 3¼ runs, left-hand twist and softer than the warp yarn. The width is 76½ in. in reed. The weave employed is three harness twill 2 up, 1 down and in the weave the warp yarn comes specially to the face and the weft yarn to the back of the fabric. —W. D.

Heather Mixes in Yarns and Fabrics. See Section 2D.

Wearing Fabrics; Thermal Conductivity of——. See Section 6.

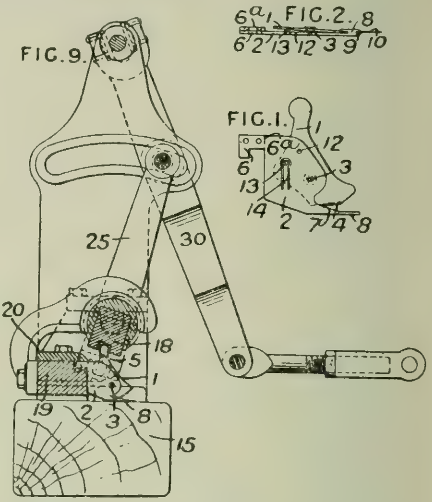
PATENTS.

Cloth for Tyre. Paul de Weerth. F.P. 512,986. Appl. 19/5/16.

This patent refers to a cloth for interior indiarubber tyres. After weaving, the cloth is hot pressed with a simultaneous tension in the direction of the warp, so that the finished cloth is equally extensible in the direction of the warp as of the weft. The cloth is more or less humidified with a liquid more or less hot. The cloth is guaranteed against the shortening of the warp by an appropriate tension and in maintaining it loose in the direction of the weft; its width diminishes, but not its length. —Bur. Text.

Looms: Pile-fabric Looms. A. Veluard, Philadelphia, U.S.A. E.P.170,886, Oct. 28, 1921. (Appl. No. 14,575/20.)

The weft floats of the fabric are cut during weaving by devices each of which comprises a hardened steel vertical member or plate 2 and a movable member 1 loosely pivoted at 3 on the member 2 and caused by projections 12, 13 to be inclined to the member 2. The projection 13 is formed on a spring tongue 14, whereby the cutting edges 4, 7 of the members 1, 2 are kept in contact. A tongue 8 on the part 2 is so bent that a perforation 9 therein, to which the pile wire is connected, lies in the plane of the cutting edge 4. The members 2 have hooked parts 6 with reinforcing plates 6^a fitting side by side in an L-shaped groove in a bar 19, and they are kept in position by a cover plate 20, the tongues resting on a beam 15. The members 1 have projecting heads 5 engaging in a longitudinal groove in a bar 18, which is rocked about end brackets and an intermediate support by lever mechanism 25, 30 operated from the lay, &c., whereby the members 1 are rocked and cut the weft pile threads advanced along the wires 10 and parts 8. The wires 10 pass through a heald. —T. W.



Woven Carrier Equipment. Frank R. Batchelder, Worcester, Mass., Assr. to Mills Belt Co. U.S.P.1,392,551, Oct. 4, 1921. Appl. 22/1/20. (10 claims: 6 printed.)

A pocketed carrier equipment consists of an accessory carrier or pocket comprising a pocket-piece having a pocket thereon and formed with a divided top margin, and a strip or band of wet material having one portion thereof formed into a cover or flap for the pocket, another portion formed into a suspensory loop at the back, and an intermediate portion tucked in and fastened between the walls of said divided top margin. —T. W.

Cotton Fabric. Georges Heberlein, Wattwill, Switzerland. U.S.P.1,392,264, Sept. 27, 1921. Appl. 18/3/21; and U.S.P.1,392,265, Sept. 27, 1921. Appl. 18/3/21.

The first relates to a cotton fabric in which the fibres have undergone a permanent structural change to produce a closer mesh fabric, with a dull, crape-like effect, like fine woollen fabric.

The second relates to a fabric having pattern effects, i.e., background portions and design portions, and in which one has the physical characteristic of mercerised fabric (soft and glossy) and the other has the physical characteristic of organdie, the contrast between said portions being such as to clearly define the desired pattern.
—T. W.

Warp Beams. Fisher and Ludlow (1920), Ltd., and A. Shaw, both of Birmingham. E.P.170,516, Oct. 27, 1921. (Appl. No. 34,764/20.)

The flange of a warp beam is formed of two pressed sheet-metal discs having lateral projections. The discs are united with the faces having the projections thereon in contact by closing an upstanding rim of the inner disc over the upstanding rim of the outer disc, and by bolts, the heads of which lie in a recess. The edge thus formed may be strengthened by a ring around which the rims are closed. The inner disc is preferably of thicker material than the outer disc. According to the Provisional Spec. the projections of one disc may enter those of the other disc. —T. W.

Winding Bobbins, etc. G. Ellam, Manchester. E.P.170,626, Oct. 25, 1921. (Appl. Nos. 17,258/20 and 9,255/21.)

The spools are mounted on horizontal spindles and the thread is laid by guides controlled by screwed spindles. The main shaft drives, by friction discs, a spindle geared by spur gearing or a chain to the spool spindle. The traverse screw is driven from the latter spindle by skew gears and friction discs. The friction-driven disc is adjustable with respect to the driving disc on the main shaft. Means are provided to adjust the pressure between the discs. The discs for the traverse can be adjusted by means of a scale to correspond to the count of yarn being spooled. —T. W.

Lace Machines and Fabrics. A. E. Stroud, Long Eaton, Derbyshire. E.P.171,124, Nov. 14, 1921. (Appl. No. 13,321/20.)

The threads used in twist lace machines may be twisted together and the weft laid in the twisted pillars. Individual or groups of weft are traversed by carriers mounted in sliding traversing blocks or may be pivoted on the comb bars. The rate of taking up the fabric can be varied, thus introducing variations in the weft. Extra thickness is introduced at those parts where the fabric is to be cut into lengths. Spec. 137,774 is referred to.
—T. W.

Looms: Loose-reed Motions. J. E. Hull, Church, Lancashire. E.P.170,767, Nov. 3, 1921. (Appl. No. 30,492/20.) Addition to 162,178.

In finger guards and heaters of the kind described in the parent Spec. the projections or studs for carrying the coil spring are detachably secured to the perpendicular base plate, and they may have detachable wing parts for the spring to bear against. Alternative methods of attaching the heater are mentioned.
—T. W.

Lace Machines. Sir E. Jardine, Nottingham, and E. Watchorn and J. W. Swindall, both of West Bridgford. E.P. 171,287, Nov. 17, 1921. (Appl. No. 28,837/20.)

The usual system of working the point-bars of plain-net and other lace machines is reversed, thus, the points are positively moved into the threads by by a cam when near the completion of the downward movement and are taken out by the section of springs after the completion of the upward movement. As the time available for withdrawing the points is longer than that available for entering them, the arrangement permits of the machine being run at a higher speed than with the usual system of working. The cam levers are loosely mounted on the dipping lever shaft and carry arms connected by short links to the lower ends of vertical levers on a shaft parallel to the dipping lever shaft. The upper ends of the vertical levers are connected by links to the point-bars by means of brackets carrying pins on which the links can slide when the point-bars are shogged. The point-bars are supported on extensions of the links provided with adjustable set-screws. Other screws carried through slots in the extensions prevent the point-bars from rising while permitting longitudinal movement.
—T. W.

Knitting Machines. P. A. Bentley and J. W. Goddard (Bentley Engineering Co.) and P. A. Bentley, Leicester. E.P. 171,483, Nov. 17, 1921. (Appl. No. 23,926/20.)

Relates to machines with two co-axial needle cylinders and double ended latch needles as described in Spec. 15008/00. The cylinders are rotated or reciprocated within stationary cam boxes as described in Spec. 24290/12. The invention comprises driving mechanism whereby two forward speeds and a reciprocating motion are obtained by means of sliding clutches controlled by a pattern drum, means for imparting a lead to the thread-guide in respect to the central stitch cam, means for operating improved needle picking devices and transfer cams, and means for automatically varying in the course of the knitting the length of loop drawn by the stitch cam. —T. W.

Knitting Machines. Wildt and Co., Ltd., and E. Wildt, Leicester. E.P.171,591, Nov. 24, 1921. (Appl. No. 29,071/20.)

Ready access to the needle cylinders for facilitating removal and renewal of needles in machines for knitting neckties and other articles and having a high cam box for use with double-butted needles is obtained by providing a gap in the cam box which is normally closable by a removable gate or block secured to the box by screws. The block carries therein a vertically slidable bolt to which the stitch cams are secured by screws. The bolt has a rearwardly projecting fork engaged by a reduced part on a thumb-screw threaded into the lower part of the block. By turning a screw, the notched head of which engages a spring, two cams are moved up and down to vary the length of loop drawn. —T. W.

Fabric. Max Katz, New York, Assr. to Voss and Stearn. U.S.P.1,393,025, Oct. 11, 1921. Appl. 6/4/20. (1 claim: 1 printed.)

A fabric is adapted to form the upper portion of an underwaist, and comprises a foundation of decorative design, reinforcements upon said foundation spaced from each other transversely of the fabric and extending in continuous lines longitudinally thereof, said reinforcements being close together and constituting guides between which the foundation of the fabric may be cut and a plurality of supplemental reinforcements extending between and connecting the first-named reinforcements at spaced intervals, any two of said supplemental reinforcements forming the opposite end terminals of said cut. —T. W.

Looms: Shuttles. British Northrop Loom Co., Ltd., Blackburn. E.P.170,696, Nov. 3, 1921. (Appl. No. 23,280/20.)

Relates to a thread guiding and tensioning device formed by a helix about which the thread passes on its way to the shuttle eye. —T. W.

Feeler Mechanism for Looms. Isaac Snow, Lawrence, Mass., Assr. to Draper Corporation. U.S.P.1,392,803, Appl. 7/10/21 (10 claims: 1 printed); 1,392,804 (6 claims: 1 printed), 1,392,805 (12 claims: 1 printed) and 1,392,806 (11 claims: 1 printed), Appl. 6/5/20; 1,392,807, Appl. 26/10/20 (12 claims: 1 printed), all of Oct. 4, 1921.

All refer to feeler mechanism for looms of the Northrop type. —T. W.

Feeler Mechanism for Looms. Edward A. Cunniff and John V. Cunniff, Fall River, Mass., Assrs. to Draper Corporation. U.S.P.1,392,817, Oct. 4, 1921. Appl. 8/5/20; (12 claims: 1 printed) and 1,392,818. Appl. 20/5/20. (13 claims: 1 printed).

Both refer to feeler mechanism for looms of the Northrop type. —T. W.

Weaving Machine. James Leamon Reynolds, Scottdale, Pa. U.S.P. 1,392,657, Oct. 4, 1921. Appl. 2/11/20. (13 claims: 12 printed.)

A series of dies are adapted to engage every other warp rod from one side, a second series of dies adapted to engage alternate warp rods intermediate those engaged by the first series and from the opposite side, said first mentioned series and last-mentioned series being shiftable transversely with respect to each other, means for imparting oppositely rocking motion to said dies, and shifting mechanism for shifting said series transversely to reposition the dies after each bending operation. ——T. W.

Take-up Mechanism for Knitting Machines. Frank P. Reynolds, Norristown, Pa., Assr. to Ballard Knitting Co. U.S.P.1,393,039, Oct. 11, 1921. Appl. 17/5/20. (8 claims: 1 printed.)

The device comprises a pair of take-up rolls, a movable support therefor, a worm and worm wheel for driving the take-up rolls, a clutch member connected with the worm having an inclined shoulder, a drive shaft extending up through the worm, a clutch member fixed on the drive shaft to move vertically therewith, having a taper pin to co-act with the inclined shoulder on the clutch member, a lever connected with the movable support of the take-up rolls and operating to effect a positive lifting action on the upper clutch member to release the side face of the taper pin from the inclined shoulder when the support of the take-up rolls moves upwardly. —T. W.

Feeler Mechanism for Looms. Alanzo E. Rhoades, Hopedale, Mass., Assr. to Draper Corporation. U.S.P.1,393,397, Oct. 11, 1921. Appl. 2/2/20. (4 claims: 1 printed.)

Relates to feeler mechanism for looms of the Northrop type. —T. W.

Thread Cutting Shuttle. William M. Rossiter, Sunbury, Pa. U.S.P.1,393,643, Oct. 11, 1921. Appl. 3/2/21. (11 claims: 9 printed.)

A cutting device for a shuttle comprises a stationary cutting element, and a swinging guiding element carried by said stationary cutting element. —T. W.

Recoil Picking Mechanism for Looms. George Crompton, Jnr., Worcester, Mass. U.S.P.1,393,758, Oct. 18, 1921. Appl. 21/4/21. (16 claims: 1 printed.)

The mechanism comprises spring means for at least partially stopping the shuttle in its box and adapted to be displaced by the shuttle in entering, said spring means acting oppositely to the motion of the shuttle in entering its box and co-acting means substantially preventing increase in the intensity in the action of said spring means as the shuttle goes into its said box. —T. W.

Tuft Yarn Spring Clip. Arthur Toppin Thompson, Hightstown, N.J. U.S.P. 1,394,050, Oct. 18, 1921. Appl. 10/8/20. (5 claims: 1 printed.)

The clip comprises a resilient strip having a laterally enlarged base portion provided with a screw opening and having a slot extending through one edge from said opening, said base portion extending at obtuse angles from the spring strip proper and said strip having a reinforcing portion adjacent the base portion and means for co-operating with the usual end member of the yarn frame. —T. W.

Knitted Cap and Method of Making Same. Elmer N. Joha, Milwaukee, Wis., Assr. to Reliable Knitting Works. U.S.P. 1,394,093, Oct. 18, 1921. Appl. 8/4/21. (8 claims: 1 printed.)

A knitted cap comprises a body portion, a head encircling band secured to the lower edge of the body portion and having portions rack knitted in opposite directions and folded upon themselves adjacent the front of said cap to form a peaked portion. —T. W.

Weft Replenishing Loom. Simeon S. Jackson, Boston, Mass., Assr. to The Stafford Co. U.S.P.1,394,175, Oct. 18, 1921. Appl. 22/12/20. (6 claims: 1 printed.)

Refers to the controlling shaft with padfinger, give-away lever, shuttle feeler, transferrer dog, transmitter rocker and other parts of a weft replenishing loom. —T. W.

Pick Stick Check. James Augustus Andrews and John William Herbert, Biddeford, Me. U.S.P.1,394,265, Oct. 18, 1921. Appl. 10/11/20. (5 claims: 1 printed.)

The device comprises a check strap with a guide, a reversible pivoted cam carried by the guide, an upper and a lower pair of spring anchors, a spring connected to the cam pivot for tensioning the latter, an eye on one end of the spring engaged with any one of the anchors of the pairs thereof, and a screw adjustably connected to the cam, the other end of the spring being formed to engage in the kerf of the screw and being removable therefrom to allow of adjustment of the screw to adjust the latter and thereby the tension of the spring. —T. W.

Artificial Textile Fabric and the Process for its Manufacture. Jacques Edwin Brandenberger, Neuilly - sur - Seine, France. U.S.P.1,394,270, Oct. 18, 1921. Appl. 18/5/20. (16 claims: 1 printed.)

The process comprises the steps of emulsifying a viscous solution and a gaseous fluid which is inert to said solution, and expressing the resultant emulsion through a drawing plate to produce an article containing an internal series of bubbles of said fluid. —T. W.

Stop Mechanism for Looms. John Ouellette, New Bedford, Mass. U.S.P. 1,394,341, Oct. 18, 1921. Appl. 30/8/19. (7 claims: 7 printed.)

The stop mechanism has a lay with opposite shuttle boxes, rock shafts, detector fingers on the rock shafts positioned adjacent the shuttle boxes, stop operating mechanism on the breast beam, means for actuating said stop operating mechanism comprising a dagger located adjacent the ends of the rock shafts, arms on the rock shafts adjacent said dagger and normally maintaining said dagger in inoperative position, and spring means for retaining the detector fingers adjacent the shuttle boxes and said arms in the path of said dagger, said means being removable and adjustable independently of the rock shafts. —T. W.

Thread Cutter for Looms. Louis Jourdain, Lowell, Mass. U.S.P. 1,393,539, Oct. 11, 1921. Appl. 21/6/20. (3 claims: 1 printed.)

The combination with a loom structure including a breast beam, a lay beam and a reed, of a rocker shaft rotatably mounted beneath the lay beam, a U-shaped bracket having a lower arm provided with an opening receiving the rocker shaft, means to releasably lock the bracket upon the rocker shaft, an adjusting screw carried by the lower arm for engaging the lay beam and limiting swinging movement of the bracket in one direction, a cutting blade carried by the upper arm of the bracket and moving through the reed when the rocker shaft is rotated in one direction, means connected with the breast beam for holding a block in operative relation to the cutting blade, an abutment connected with the breast beam, and movable into and out of an operative position, a lever arm mounted upon the rocker shaft, and an abutment carried by the lever arm for engaging the abutment of the breast beam and swinging the lever to rotate the rocker shaft and move the blade carried by said bracket through the reed into engagement with the block when the abutment of the breast beam is in an operative position. —T. W.

Reed for Spacing Warp Threads. Charles Lea, Boston, Mass., Assr. to American Warp Drawing Machine Co. U.S.P. 1,394,431, Oct. 18, 1921. Appl. 17/9/15. Renewed 19/1/21. (16 claims: 11 printed.)

The evener comprises a longitudinal supporting bar, a collapsible and expansible reed structure mounted thereon having dents normally spaced apart, supporting brackets for said bar, a longitudinal shaft parallel with said bar, a series of arms pivotally connecting said bar with said shaft, the upper ends of said brackets being formed and proportioned supportingly to engage the underside of said bar when the reed is in operative position while allowing said bar to swing downwardly therefrom. —T. W.

Loom Attachment. Charles E. Chambers, Asheville, N.C. U.S.P.1,395,904, Nov. 1, 1921. Appl. 7/7/19. (4 claims: 1 printed.)

A picker stick for looms comprises a flexible loop extending around the picker stick, a plate adjustably secured to one side of the lay and means for securing the loop to the plate, whereby a side pull will be exerted upon the picker stick at the end of its stroke. —T. W.

Electric Jacquard for Mechanical Weaving of Laces. Vacher et Maréchal. F.P. 512,622. Appl. 27/8/19.

This apparatus, which can be applied to all kinds of looms, is characterised by the following:—(1) The picked paper or card is unrolled with a uniform or continuous motion—relatively slow compared with the speed of the loom—through an electromechanical apparatus with special rollers; (2) the rectilineal alternate motion of the card is suppressed, as well as the jacquard needles ordered, by this motion; (3) the draught rods or hooks are suppressed when the loom on which the apparatus is mounted makes it possible. All these results are obtained by electro-mechanical and electro-magnetic means possessing a roller driving a special card, a special commanding roller, a special distributor, and a series of electro-magnets. —Bur. Text.

Automatic Shuttle Changing in Looms. U. Caillon. F.P.513,799. Appl. 13/8/18.

This process consists in the use of looms with rising boxes and in adding a disposal which acts at the moment when the cop of the shuttle is to be out, causing the automatic changing of the box containing this shuttle and its replacement by a box containing a full shuttle. The device comprises:—(1) A driving apparatus for changing the boxes comprising a rod acted by an electro-magnet; this rod allows the working or non-working of the racket moving the changing card. An auxiliary electro-magnet conserves the current during the necessary time. (2) An interruptor moved by changing hooks at the moment when the changing of box takes place. (3) An electric feeler which distributes the electric current to the above apparatus when the shuttle is terminated. —Bur. Text.

4.—CHEMICAL AND OTHER PROCESSES.

(B)—SCOURING AND DEGUMMING.

"Rapidase." L'Ind. Text., 1921, **37**, 473-474.

A description is given of a new ferment which may be used in place of malt for the degumming of textile fabrics. The advantages claimed are (*a*) absence of albumin; (*b*) rapidity of action, resulting in a 25—30% economy of steam; (*c*) economy of material, 10 parts of rapidase being equivalent to 15 parts of malt; (*d*) higher temperatures than are possible with malt may be advantageously used with this ferment; (*e*) the alkalinity of the substance allows degreasing to be carried out simultaneously. The ferment is of bacterial origin, and has apparently been evolved by A. Boidin, Prof. Effront and the "Amylo" Co. —J. C. W.

(E)—DRYING AND CONDITIONING.

Drying by Means of Air. C. T. Mitchell. Chem. and Met. Eng., 1921, **25**, 1,088-1,090.

The calculation of the volume of air required in air drying is discussed, and curves are derived intended primarily for the use of the engineer or plant manager who requires to know what quantity of air, under certain conditions of temperature and humidity, is necessary to evaporate a given amount of moisture. The curves are plotted for three conditions of ultimate humidity—100, 85, and 70%. —J. C. W.

(G)—BLEACHING.

Bleaching. Hottenroth. Papierfabrikant, 1921, **19**, 1395-1396.

A paper given at the Conference of the Association of Cellulose and Paper Chemists and Engineers. Though acidification of the bleaching bath greatly accelerates the process, it does not find general application because sulphuric acid is used and attacks the fibre. Carbon dioxide similarly accelerates the process and does not endanger the fibre. A comparison of the effect of acidification by carbon dioxide and of raising the temperature of the bleaching bath shows that for the same quantity of chlorine used the bleaching effect of the warm alkali bath is greater than that of the acidified bath. The most effective bleaching is obtained by treating the goods in an acidified bath and then in an alkali bath. In the discussion of the paper, Dr. Waentig and Schacht spoke in favour of the combined bleach, but the latter stated that in the manufacture of paper it is preferred to reverse the order and treat goods in the acid bath last because of the subsequent sizing. —J. C. W.

Methods for Silk Bleaching. L'Avenir Text., 1922, **4**, 130.

The "aqua regia" method is described, the need for extreme care in watching the exact moment for withdrawal from the bath being especially insisted upon. Tussah, waste and spun silks need longer treatment with alkaline peroxide than do ordinary silks; permanganate will not do. The adjustment of the alkali to avoid waste of oxygen is mentioned and details given. Some formulæ are also given:—10 kg. degummed silk is immersed in a bath of 45 litres hydrogen peroxide, 3 vols., neutralised by ammonium chloride to which 200 gram potassium chlorate and 22 gram sodium nitrate have been added. The goods are soaked without intermediate washing for two periods of 12 hours, then washed and dried. A degumming treatment for tussah silk is also given. —F. G. P.

Hypochlorite Solutions; The Stability of—. See Section 6.

(H)—MERCERISING.

The Inter-relation of Mercerisation and Spinning. H. Lowe, Jl. Soc. Dyers and Col., 1921, **37**, 296-298.

When yarn is mercerised to "spinner's length" and washed without tension it becomes (1) more slender, (2) stronger, (3) more uniform, and (4) it receives more twist; in other words, mercerising has the effect of further spinning the yarn. In favourable cases, the increase in twist may be from 10 to 17 or 24 to 40 per inch; the increase of strength may be 14·25%, and the diameter may be decreased by 18%. The effects are due to the closer packing of the fibres in the plastic state.—J. C. W.

(I)—DYEING.

Zinc Formaldehyde Hydrosulphite; Preparation of——. Ph. Malvezin, Ch. Rivalland and L. Grandchamp. Compt. Rend., 1921, **173**, 1180-1182.

When sulphur dioxide is allowed to diffuse through a Chamberland filter into a 40% solution of formaldehyde until the density becomes 30° Bé, the resulting solution of hydroxymethylenesulphurous acid appears to contain formaldehyde hydrosulphite as well. If zinc dust is suspended in the liquid during the operation, a concentrated solution of zinc formaldehyde hydrosulphite is obtained, which crystallises on cooling. Using trioxymethylene instead of formalin, compounds have been obtained which yield reducing agents on treatment with moisture and can be used with success in the discharge of vat dyes. —J. C. W.

Dyeing Silk with Logwood. Posselt's Text. Jl., 1921, **29**, XXII.

Logwood, in the form of logwood extract, is used for the weighting and black dyeing of silk. The degummed silk is immersed in an iron-salt solution, wrung, washed and passed through soap or tan, and then through logwood: 100% weighting is now considered the maximum for good work, and the average is much below this. The amount of weighting is frequently expressed in ounces above the 12oz. of degummed silk. Tin weighting is also mentioned. Tin chloride, it is said, is absorbed by the degummed silk, decomposed by water into insoluble tin oxide, and transformed into insoluble tin phosphate by sodium phosphate. The tin bath should be cold at 50—53°Tw., the phosphate 9°Tw. at 65°C. After washing the silk is ready for a bath of logwood and soap at near boiling. The whole operation may be repeated twice, giving in all about 16oz. additional weight. —F. G. P.

Vat Dyestuffs; Contribution to the Study of——. See Section 6.

Developed Dyes; Some——. G. Emmons. Silk, N.Y., 1921, **14**, 73-75, 88.

In general, substantive colours applied to silk and then diazotised and developed yield shades that are of good fastness to water and boiling soap. A list of dyes is given, divided into classes according to the most suitable developer; the greatest number are in the B-naphthol class. After dyeing the goods are treated in a cold solution of 4% sodium nitrite and 6% sulphuric acid. After washing they are soaked for 15 mins. in a cold bath containing 1% B-naphthol dissolved in 1% caustic soda solution at 77°Tw.; they are then rinsed and washed in hot soap and treated with dilute acid. —F. G. P.

Dyeing Cotton and Silk Mixed Hosiery. Posselt's Text. Jl., 1921, **29**, 83.

Direct cotton colours in a neutral bath will dye both fibres, though in some cases a little shading is needed on the silk. Several of the acid colours will tint silk from a neutral bath without appreciably affecting the cotton. Weighted silk is stated to be less absorbent of some colours than unweighted. For degumming a bath of 10% olive soap and 1% soda ash is recommended, the goods being subsequently rinsed twice in water heated to 100 to 111°F. —F. G. P.

Practical and Technical Dyeing Difficulties. See *Jl.* Proc., 1922, **13**, 7.

(J)—PRINTING.

Basic Azo-dyes; Printing with——. F. V. Kallab. Bull. Soc. Ind. Mulhouse, 1921, **87**, 287-29. (Pli cacheté, 999 of 1897.)

Details are given of a method for printing basic azo-dyes on vegetable fibres by means of tannin and tartar emetic. —J. C. W.

Metallic Powders; Printing with——. J. Frossard and C. Rebert. Bull. Soc. Ind. Mulhouse, 1921, **87**, 284.

Egg albumin is recommended as a thickening and fixing agent for printing metallic powders on cotton. A method of printing raised fabrics is also described.—J. C. W.

(K)—FINISHING.

Narrow Fabric Shearing. Textiles, 1921, **19**, 27.

This device is designed to allow of a plurality of narrow fabrics being sheared at one time when the ends of the bands are sewn together to form an endless belt which may be fed continuously through the machine as many times as may be desired. The machine is designed to prevent cutting of seams when a number of fibres are sheared at one time, and it is provided with a plurality of independent sections combined with suitable means of controlling each rest section independently of the other, and as the seam approaches the cloth is not cut. —W. D.

Scroop. Posselt's Text. Jl., 1921, 29, XXIII.

Scroop is the peculiar rustling sound made by clean silk when compressed. Attempts have been made with some slight success to impart this characteristic to mercerised cotton. Scroop is not natural, but is the result of passing finished silk through an acid bath, preferably tartaric, though commercial lime juice is said to give a more lasting effect. The most satisfactory explanation of the scroop at present advanced is that the acid roughens the surface, and this causes the noise when compressed. —F. G. P.

Gambier Cutch (for Silk Weighting). J. Zubelen. Bull. Soc. Ind. Mulhouse, 1921, 87, 279.

Catechin is said to possess little affinity for tin-weighted silk; purer qualities of gambier extract are less successful for weighting than crude varieties. In Indragiri gambier, catechu tannic acid which has weighting properties can be separated from catechin which actually has a reducive effect. On boiling in air, however, these two bodies react, giving rise to suitable weighting compounds.

—F. G. P.

Dyeing Silk with Logwood. See Section 4I.

PATENTS.

Dyeing Machine. Howard M. Dudley, Philadelphia. U.S.P.1,395,669, Nov. 1, 1921. Appl. 1/12/19. (8 claims: 1 printed.)

The machine comprises a receptacle with a stationary shaft passing through it, a revoluble sleeve supported by the shaft, means for revolving the sleeve, a series of foraminous dyeing chambers carried by the sleeve within the receptacle, a chamber surrounding the foraminous dyeing chambers, means whereby a liquid may be introduced simultaneously and continuously into all portions of one end of the surrounding chamber, and means whereby the liquid may be passed through the dyeing chambers and then through the receptacle. —T. W.

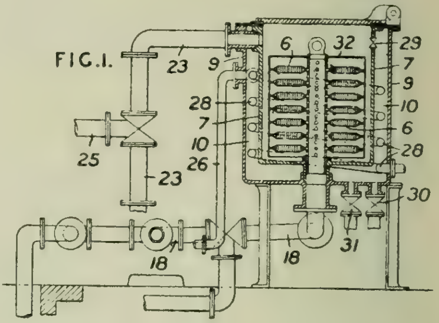
Electric Cloth Cutter. Frank A. Scalfaro and John A. McLeod, Chicago. U.S.P. 1,395,150, Oct. 25, 1921. Appl. 21/8/20. (3 claims: 1 printed.)

The device comprises a substantially triangular frame having its inclined rearward side formed into a handle portion and being adapted to be slidably moved along a flat surface, a rotary cutting blade mounted at the forward end of the frame, an electrically actuated driving mechanism disposed along the inclined upper side of said frame and operatively connected with the cutting blade, and means positioned beneath the cutting blade and extending forwardly thereof for guiding work into position to be cut by the rotary cutting blade. —T. W.

Treating Textile Materials with Fluid. F. Ferrand, Southport, and F. Riley, Bury. E.P.170,956, Nov. 4, 1921. (Appl. No. 22,969/20.)

The fluids for bleaching, dyeing, and similarly treating yarn in cop, cheese, or other compact form, are circulated by a pump driven by a steam engine, and the exhaust from the latter is utilised to heat the fluids or keep them hot without coming into contact with them, and it may be circulated by the pump to treat the material. The cops 6 are arranged in a perforated annular chamber 32 mounted in a closed vessel 7, surrounded by a jacket 9.

FIG.1.



The fluid is supplied through a pipe 23 into the vessel 7 by a turbine pump driven by a steam turbine, and is returned through a pipe 18. The exhaust steam from the turbine is passed by a pipe 26 into the annular space 10 between the jacket 9 and the vessel 7, and passes through an outlet 30. Valves and pipe connections are arranged to allow the dyeing or washing fluid to be circulated through the material, and to return the liquor to tanks or otherwise, as desired. When it is required to steam the material, exhaust steam is passed through a valve 29 into the vessel 7, and is drawn through the pipe 18 to be exhausted through a pipe 25. When it is required to dry the material in the vessel 7, the exhaust steam is passed through a coil 28, the suction of the pump then drawing heated air through the vessel 7, the valve 29, and the space 10 from an air inlet 31. —T. W.

Drying Apparatus. Elwood B. Ayres and Hermann Bogaty, Philadelphia, Assrs. to The Philadelphia Textile Machinery Co. U.S.P.1,393,003, Oct. 11, 1921. Appl. 1/12/19. (4 claims: 1 printed.)

The drying apparatus comprising a drying chamber, an endless chain conveyor therein, pans pivoted to the conveyor and hung below the chain, each pan having a lip at each end shaped so that the lip of one pan will interlock with the lip of the adjoining pan, means at each end for discharging the pans, means for releasing the lip of one pan from that of an adjoining pan, and means for feeding the material to the pans. —T. W.

Dyeing Machine. James H. Thompson, Trenton, N.J., Assr. to Hussong Dyeing Machine Co. U.S.P.1,395,165, Oct. 25, 1921. Appl. 23/11/18. (5 claims: 1 printed.)

The machine has, in combination, a vat having a solid structure at one end with vertical cylindrical passages of an even diameter throughout and rotating circulating propellors of substantially the same size as the passages and mounted therein. —T. W.

Application of Iso-Propylnaphthalenesulphonic Acid. Badische Anilin und Soda Fabrik. G.P.336,558. Leipzig, Monatschr. Text. Ind., 1921, **36**, 195.

Salts of the sulphonic acids of aromatic hydrocarbons proplyated in the nucleus will dissolve fats and oils, and may be used as substitutes for soap, Turkey-red oil, etc. Their solutions in organic solvents such as tar oil form stable emulsions with water which may be used as lubricants for metal drills or as peptising agents. The preparation of the naphthalene derivative is described. —J. C. W.

Cellulose Acetate Products; Treatment of——. British Cellulose and Chem. Mfg. Co., and J. F. Briggs. E.P.169,741, Sept. 29, 1921. (Appl. No. 11,886/20.)

Filaments and fabrics made from lower acetates of cellulose (with 2—2½ acetyl groups to the molecule of $C_6H_{10}O_5$) and not from the partly hydrolysed higher acetates are given greater affinity for dyestuffs by superficially hydrolysing with 0·1—1% solutions of caustic soda at 40°—80°C. in such a way that not more than 10% of the material is lost. After washing and scouring the goods may be dyed, or the operations of hydrolysing and dyeing may be done together if suitable dyes are used (direct cotton, sulphur, or vat dyes). The treatment is stated to not materially affect weight, strength, etc., and renders it possible to use dyes not otherwise available. By varying the degree of hydrolysis the shade may be altered. —F. G. P.

Measuring Machine Attachment for Cloth Winding Machines. Douglas Turner, St. Louis, Mo., Assr. to The Measuregraph Co. U.S.P.1,391,431, Sept. 20, 1921. Appl. 11/8/19. (4 claims: 1 printed.)

A cloth winding machine comprises a frame, a roller supported by said frame, means for drawing the cloth past the said roller, a measuring machine having indicating mechanism and having a measuring roller lying adjacent to the face of the first-named roller and transmitting a part of the weight of the machine to said first-named roller, said driving roller operating to actuate the indicating mechanism when the cloth is pulled between the said rollers, a head having two forks supported on said frame, a knuckle pivotally supported between said forks, and a swivel connection between said knuckle and said machine. —T. W.

Finishing or Lustreing Textile Fabrics. Joseph Bolton Lomax, Furness Vale, England. U.S.P.1,393,296, Oct. 11, 1921. Appl. 10/4/20. (3 claims: 1 printed.)

Process of finishing fabrics consists in passing the cloth between a plurality of rollers under high pressure and heat and while hot applying thereto a boiling finishing liquor while retaining the fabric under tension, and winding the said fabric into a roll while in the hot condition. —T. W.

Fabric Measuring and Cost Computing Machine. Douglas Turner, St. Louis, Mo., Assr. to The Measuregraph Co. U.S.P.1,392,723, Oct. 4, 1921. Appl. 21/6/19. (21 claims: 1 printed.)

A machine for measuring lengths of fabric drawn from a bolt or roll comprises a measuring roller, indicating mechanism including a scale, means for driving the indicating mechanism from said measuring roller, said mechanism including an independent hand-actuated part, operated at will when a remnant is to be measured, for increasing the reading of the indicating mechanism at said scale. —T. W.

6.—ANALYSIS, TESTING, GRADING, AND DEFECTS.

Spots and Streaks in Coloured Silk Fabrics; Cause of——. Posselt's Text. Jl., 1921, **29**, 80.

Sometimes when silk is sewn to wool in garments the silk will absorb grease from the other fabric. Small traces of sodium chloride produce stains and tenderness on weighted silk goods. Care should be taken not to use dyes affected by weak acids on silk goods for linings. Different sorts of silks when mixed often give varied shades; steel, pearl, and other greys are very sensitive to such differences. Neutral soap should be used in degumming, because free fat is said to produce tin compounds which, on storage, may cause fading and tenderness. Thorough washing at all stages is essential, as is also extreme care in making additions of colour to the dye baths. Temperatures should be raised slowly to avoid irregularity in shade. The presence of sulphurous acid in the air is a cause of trouble. Size and finish of unknown composition may produce streaks with certain colours; if gum arabic is used soap and glycerine should be added to reduce harshness. —F. G. P.

Hydrocellulose; Test for——. Ed. Justin-Mueller. Bull. Soc. Chim., 1921, **29**, 987-988.

The author finds that between 130° and 140°C. hydrocellulose begins to turn yellow and form caramel, that oxycellulose scarcely turns yellow at 145° to 150° and that cellulose only begins to turn yellow at 180°. This fact can be used as a characterisation of hydrocellulose, even in the presence of cellulose and oxycellulose. —J. C. W.

Apparatus for the Determination of the Tearing Strength, Extensibility and Torsion Strength of Single Fibres. P. Krais. Deuts. Faserstoffe (from Text. Forschung, 1921, **3**, 86-89), 1921, **3**, 111.

Gives a brief description of the apparatus designed to test the above properties of single fibres. —W. R.

Studies on the Formation of Natural Silk Thread. E. Hirazuka. Bull. Imp. Sericul. Exp. Sta., Nakano, Tokyo, Japan, 1918, **1**, 203.

A study of the colloid chemistry and physics of silk formation. Liquid silk is unstable, and has a tendency to coagulate. Coagulation is accelerated by mechanical action, *e.g.*, pressing or stretching, or by hydrogen ions. Liquid silk may be coagulated artificially into fibrillary gel by increasing the internal friction and the mechanical action of stretching. Outward appearance and internal structure of thread so produced do not differ from those of natural silk. The structure of the cocoon fibre is discussed, and that the spinning of the cocoon fibre is due to the action of drawing out and stretching of liquid silk is supported by considerable experimental evidence. The subject is treated historically, and there is a useful bibliography. —E. A. F.

Analysis of Silk-Wool Fabrics. Posselt's Text. Jl., 1921, **29**, XIX.

The sample is treated with dilute HCl then Na_2CO_3, to remove finish, dried, and weighed. Concentrated HCl (40%) is used at 50°C. to dissolve out the silk. The wool is washed, dried and weighed. Another method is to boil the sample for 5 min. in turbid ammonia-nickel hydroxide solution, remove the wool, wash with water and with HCl to remove the nickel, then dry and weigh. Boiling basic zinc chloride dissolves silk rapidly (wool more slowly). The wool needs washing from zinc salts with dilute (1%) HCl and water. Silk in a fibre may be identified under the microscope. Two methods are also described for the analysis of wool-silk-cotton fabrics and also a method for analysing cotton-linen fabrics.—F. G. P.

Starch. T. Isawa. Physiol. Abstr. (from J. Med. Soc. Kyoto, 1921, **18**, 49-82), 1921, **6**, 408.

The digestion of soluble starch by amylolytic enzymes is considerably retarded if the starch solution is first mixed with sodium oleate, but not if the soap is first added to the enzyme. The soap does not, therefore, inactivate the enzyme, but protects the starch granules in some way. —J. C. W.

Filters. E. E. Finch. Jl. Ind. Eng. Chem., 1921, **13**, 996-997.

Pure cotton mass is recommended in clarifying filters. The size, type and preparation of the filter mass and the pressure to be employed are discussed. —J. C. W.

Vat Dyestuffs; Contribution to the Study of——. M. Battegay and J. Claudin Chim. et Ind., 1921, **6**, 592-595.

Experimental evidence is brought forward in support of the idea that in vat dyeing in addition to the simple deposition of the colour in the interstices of the fibre by oxidation there exist other forces, either chemical or adsorptive. Bulk indigo easily forms a green-coloured sodium salt with sodium alcoholate, whilst when dyed on cotton it does not. It might be imagined therefore that in the dyed material there exists chemical combination between the indigo and the cellulose. This is further supported by the fact that if indigo hydrosol be dyed on cotton the dyeing is very imperfect and gives the green salt with alcoholic soda. In the case of indigo therefore it is possible that the process comprises insolubilisation by oxidation, chemical combination with the cellulose, and fixation by adsorption. The colour of the dyed cotton does not afford much direct evidence of the affinity between dyestuff and fibre. Quantitative extractions with organic solvents show that dyeings with equal percentages of the α and β benzoylaminoanthraquinones or with the dibenzoyldiaminoanthraquinones contain equal amounts of fixed colour. The relative affinity of these compounds is therefore independent of the final coloration of the dyed cotton, and of the position and number of the benzoylamino groups in the anthraquinone molecule. —F. C. W.

The Thermal Decomposition of Sucrose under Reduced Pressure. (Destructive Distillation of Cellulose.) J. Reilly. Jl. Soc. Chem. Ind., 1921, **40**, 249T.

In a communication on the destructive distillation of sucrose under reduced pressure, the author reproduces the results of Bantlin's work (J. Gasbeleucht, **1914**, **57**, 32, 55) on the destructive distillation of sucrose, starch and cellulose at ordinary pressure and at temperatures between 100° and 500°C. —J. C. W.

Cellulose Ester Solvent. H. F. Willkie. Chem. Tr. Jl. (from Chem. and Met. Eng.), 1922, **70**, 39-40.

The successful production of anhydrous ethyl acetate as a cheap and effective substitute for amyl acetate as a cellulose ester solvent is described. Anhydrous ethyl acetate may be prepared free from both alcohol and water. Ethyl acetate has suffered from adverse criticism due to information based on experiments with impure products. The author states that pure ethyl acetate does not become strongly acid on standing either alone or diluted with 95% alcohol. It is also stable to hot water. Iron drums in which the material is stored for months show no trace of corrosion. Furthermore, pure ethyl acetate is not hygroscopic. Figures are given for the solvent power of this solvent for cellulose nitrates and acetates. —F. C. W.

Raw Silk; The Examination of——to Determine its Mechanical Fitness for Manufacturing Purposes. W. F. Edwards. Silk, N.Y., 1921, **14**, 50-57.

The methods for determining stress and strain relations of wrought iron and mild steel are described, with a view to indicating what variations must be made in the study of raw silk. In dealing with silk the variability of the results is alluded to, a difference of 25% being not uncommon. Illustrations are given of serigraphs and silk testing machines and figures showing the elasticity, tensile strength, cohesion and other tests. —F. G. P.

Starch; Colloid Properties of——. J. J. L. Zwikker. Rec. trav. chim., 1921, **40**, 605-615.

Solutions of various starches were prepared (*a*) by grinding the starch in cold water, (*b*) by boiling starch with water, and the effect of ultrafiltration on these solutions was studied. The solutions (*a*) contained amylose after filtration, while solutions (*b*) did not, whence it is assumed that boiling increases the size of the particles. Some other unknown cause must also be operative, however, since solutions (*a*) if boiled after ultrafiltration, showed little increase in the size of the particles. This decrease of the degree of dispersion is a reversible process, since solutions (*b*) which were allowed to stand for some time retained amylose in solution after ultrafiltration. The viscosity of starch solutions has no relation to the amount of amylophosphoric acid in the substance, but is greatly influenced by the nature of the metallic cations present, which has also a considerable effect on the adsorptive properties of the starch. —J. C. W.

Cellulosic Materials; The Hydrolysis of—. Chem. Tr. Jl., 1922, **70**, 43-44.

In the second memorandum of the Fuel Research Board on "Fuel for Motor Transport" the views are expressed that waste cellulosic material must constitute our main source for the supply of power alcohol and that biological methods for the decomposition of such material offered the greatest hope for success. Hydrolysis with dilute acids is impracticable. Recent progress has been directed towards hydrolysis with concentrated hydrochloric acid in two stages, the first stage being treatment of the moist material with gaseous hydrochloric acid. The acid is absorbed in the material, and after considerable dilution with water a secondary hydrolysis is carried out at the boil. This (Dangeville) process has been investigated by Wohl and Krull (*Cellulosechemie*, 1921, **1**, 1), who find that the primary hydrolysis is best carried out at 20°C. for 5 hrs. In the secondary process boiling must not be continued after 8 or 9 hrs. From 60—70% yield of glucose is thus obtained. The glucose in the residues may be reduced in amount by pre-treatment of the material with ozone, air at 150°—160°C., chlorine, bleach or water under pressure.—F. C. W.

Hypochlorite Solutions; The Stability of—. Chem. Tr. Jl., 1921, **69**, 823.

To prepare a comparatively stable Carrel-Dakin solution (a neutral solution of sodium hypochlorite containing 0·4—0·5%) it is absolutely necessary to use only the exact quantity of sodium bicarbonate required for neutralising the free alkali of the solution. —F. C. W.

Cellulose Esters; Viscosity of——. Anna von Fischer. Koll. Zeitsch., 1921, **29**, 260-265.

The viscosity of a number of acetylcelluloses has been measured under various conditions with a view to finding a method of testing such substances for the purpose of controlling their industrial application. It is found that (*a*) an acetylcellulose which gives a good product shows a minimum viscosity in acetone-alcohol solution when the solvent contains 80% by volume of acetone; (*b*) addition of camphor or triacetin raises the viscosity in pure acetone; (*c*) the effect of adding dichlorhydrin or p-tolusulphonamide is irregular. A nitrocellulose which yields a good celluloid has its viscosity in alcoholic solution lowered by increasing amounts of camphor, while the reverse takes place with a nitrocellulose yielding a bad celluloid. —J. C. W.

Textile Calculations; Graphic Method for—. C. Goldthwait. Text. World Jl., 1921, **60**, 29-31.

An article describing the principle, construction and use of alignment charts for determining weights of goods, shrinkages, moisture content, routine chemical analyses, etc. The method when properly applied even replaces computing machines. —F. C. W.

Amylase. U. Olsson. Chem. Zentr. (from Zeitsch. physiol. Chem., 1921, **114**, 51-71), 1921, iii, 1290

Directions are given for the preparation of an amylase solution from barley. The poisoning effect of silver, copper and aniline on amylase has been studied. Silver salts produce an immediate inactivation, while with copper the action takes some time. With both these substances a weak spontaneous regeneration may be observed. Aniline is poisonous only in much higher concentration. —J. C. W.

Improvements and Modifications in the Gauge Test. W. P. Seem. Silk, N.Y., 1921, **14**, 39-44.

A record of advancement in practice and change in methods experienced by the author since he published a pamphlet in 1919 is presented. Very weak threads are those which break at or below 24 grams. This is arrived at by taking 50% of the size to be very weak, for example in 11/13 den.=6 deniers; if this be multiplied by 4 it gives the breaking strain in grams for very weak threads, and so on for other sizes. Very full tables are given and some brief description of an improved testing machine. —F. G. P.

Mould Hyphæ; Microscopy of——. Margaret B. Church and C. Thom. Science, 1921, **54**, 471.

With such a combination as a Zeiss 3 mm. N.A. 1·30 apochromatic objective and a 12X compensating ocular, the close relation of mould hyphæ to certain substrata such as sugar crystals or soil particles can be demonstrated. Few other available combinations will give the necessary clarity of field, magnification and working distance. —J. C. W.

Turkey-red Oil Substitutes. N. Welwart. Chem. Zeit., 1921, **45**. 990.

A brief account of the preparation, analysis and properties of some substitutes for Turkey-red oil, including "Monopol soap," "Iso soap," "Turkon oil" and "Monopol oil." —J. C. W.

On the Action of Dilute Sulphuric Acid on Cotton Cellulose, and an Improved Method of Testing for Oxycellulose. E. Knecht and F. P. Thompson. Jl. Soc. Dyers and Co., 1921, **37**, 270.

Cotton which has acquired an increased affinity for Methylene Blue and a decreased affinity for Diamine Sky Blue by treatment with dilute sulphuric acid is not oxidised cellulose, but contains fixed sulphur which is not removed by washing with boiling water or alkali. The characteristic affinity of Chardonnet silk for basic colours is due to the sulphur (or sulphuric acid) fixed during the nitration with mixed acids and not during denitration. The affinity of oxidised cellulose for leuco-Methylene Blue is very slight, whereas it is very marked in the case of the sulphuric acid product. Oxidised cellulose and sulphuric acid-treated cellulose may be distinguished by boiling with weak alkali and then dyeing with a direct colour (Diamine Sky Blue). —L. M. S.

Paraffin Embedding. C. Peters. Chem. Zentr. (from Compt. Rend. Soc. Biol., 1921, **85**, 15-16), 1921, IV., 1121.

A method of paraffin embedding is described, in which amyl alcohol is used instead of absolute alcohol. The amyl alcohol may be easily purified and used again. —J. C. W.

Polyamylose Alkali Compounds. P. Karrer. Helv. Chim. Acta., 1921, **4**, 811-816.

Diamylose (anhydro-maltose) and its polymerides α-tetra-amylose, β-hexa-amylose and α-octa-amylose dissolve readily in dilute sodium hydroxide, and when alcohol is added to the solutions, white, amorphous compounds are precipitated which contain exactly 1 mol NaOH to 1 mol $C_{12}H_{20}O_{10}$. The analysis of such compounds thus affords a clue to the molecular weight of the anhydro-sugar of which the complexes are the polymerides. For example, the figures quoted by Pfeiffer and Tollens for the alkali compounds of inulin and xylan would indicate that the former is a polymerised anhydro-di-fructose and the latter an anhydro-di-xylose. —J. C. W.

Fehling's Solution; A Modification of——. F. A. Quisumbing and A. W. Thomas. Jl. Amer. Chem. Soc., 1921, **43**, 1503-1526.

The sources of error involved in the quantitative determination of reducing sugars by Fehling solution are discussed. An extensive investigation with a view to establishing the conditions under which these errors are eliminated or reduced to a minimum is described. A modified solution and sugar table are proposed by the authors and the limits of accuracy of the new method are indicated. —J. C. W.

Lignin and Resins and Tannins of Pine Needles. Astrid Cleve von Euler. Cellulosechemie, 1921, **2**, 128-135.

A review of the chemistry of the resins and tannins of pine needles, with reference to its bearing on the constitution of lignin. —J. C. W.

Plant Membranes; Absorptive Power of—. L. Rosenthaler. Cellulosechemie (from Ber. d. Dt. pharm. Ges., **1921**, **31**, 27-30), 1921, **2**, 78.

The plant membranes which can take up iron from solutions of iron salts can be divided into two groups, those which become blue immediately on addition of potassium ferrocyanide after treatment with ferric chloride, and those which show this property only after the addition of acid. Cellulose belongs to the latter group and takes up iron from ferric chloride solutions as ferric hydroxide, but it does not absorb ferrous salts. —J. C. W.

Carpets and Mats; Testing of——. S. A. van Hoytema. Leipzig Monatschr. Text. Ind., 1921, **36**, 201-202.

A report of comparative tests on carpets, stair carpets and mats manufactured from cocoanut fibre, paper, sisal, cow hair, jute and rush. The present instalment deals with tensile tests of the fabric (Goodbrand apparatus) and yarn (Schopper), and also with tests of the wearing properties. For the last purpose, the material was pressed under constant loads on a flat grindstone and the loss in weight was determined after definite times of revolution. The attritiometer is figured in the text. —J. C. W.

Lignin; Methylation of——. E. Heuser, R. Schmidt, and L. Gunkel. Cellulosechemie, 1921, **2**, 81-86.

Notes on the following subjects are recorded:—(1) Isolation of lignin, with methoxyl=14·65%, from pine wood; (2) Successive methylation with methyl sulphat; first treatment gave methoxyl =20·7%, sixth treatment 26·3%; (3) Demethylation of lignin by repeated heating with 5% hydrochloric acid under pressure; (4) Methylation of demethylated lignin; three treatments with methyl sulphate gave methoxyl=5·8%; (5) Methylation of lignin dissolved in 5% sodium hydroxide at 170°C.; four treatments with methyl sulphate gave methoxyl=24·7%.—J. C. W.

Alpha-Cellulose; Estimation of——. Papierfabrikant, 1921, **19**, 1396-1398.

In a lecture (given at the Conference of the Association of Cellulose and Paper Chemists and Engineers) on "The Determination of the So-called α-Cellulose," Waentig puts forward a number of rules which should be observed in testing sulphite cellulose in order to obtain comparative results. He suggests also that the terms α-, β-, and γ-cellulose shall be avoided as far as possible. The substitution of "mercerised cellulose" for α-cellulose is proposed. In the discussion, the question of the most suitable filter for use in the determination of α-cellulose was raised. Waentig stated that the difficulty was most easily overcome by using caustic soda of such a dilution that filter papers could be used. Hottenroth referred to the use of porcelain filters in this connection. —J. C. W.

Cellulose Alkali Compounds and the Constitution of Cellulose. P. Karrer. Cellulosechemie, 1921, **2**, 125-128.

A discussion of the constitution of alkali-celluloses by analogy with the alkali-hydroxide-additive compounds of starch, inulin, and the polyamyloses (see above). The author concludes that cellulose is a polymerized cellobiose anhydride and correlates this with other evidence. —J. C. W.

Oxycellulose; Composition of——. E. Heuser. Papierfabrikant, 1921, **19**, 1393-1394.

In a lecture (given at the Conference of Cellulose and Paper Chemists and Engineers) on "Problems of Cellulose Chemistry" Heuser states that oxycellulose is impure cellulose contaminated with small quantities of an oxidation product which appears to be in close union with some part of the cellulose. He discusses Pringsheim's views, the chief feature of which is that the oxidation of cellulose proceeds in two stages—first, hydrolysis; second, oxidation. He inclines to the modern view that depolymerisation precedes the production of oxy- and hydrocellulose and this also may apply in the mercerisation of cellulose. A real difference between oxy- and hydrocellulose is that oxycellulose gives up carbon dioxide on distillation with hydrochloric acid. In the discussion, Waentig said that experience gained in the production of artificial silk also shows that depolymerisation takes place, the xanthate solution having a low viscosity.—J. C. W.

Cellulose Benzyl Ethers. M. Gomberg and C. C. Buchler. Jl. Amer. Chem. Soc., 1921, **43**, 1909-1911.

The authors find that cellulose which has been previously subjected to "hydration" processes can be benzylated by the use of benzyl chloride under suitable conditions. The authors appear to have isolated mono-, tri- and tetra-benzyl derivatives of cellulose. Several chemical properties of these benzyl derivatives are given. —J. C. W.

Cuprammonium Solutions. W. Traube. Ber., 1921, **54**, 3220-3232.

The author describes experiments which show that the solvent action of alkaline or ethylenediamine solutions of polyhydric alcohols, etc., for cupric hydroxide is due to the formation of complex alcoholates and the like. The same explanation is employed in the case of "cuprammonium" solutions. For example, a 13% solution of ammonia dissolves only about 0·7% of copper hydroxide, *i.e.*, the ratio $CuO:NH_3$ is about 1·71. When cellulose, glycerol, or mannitol are added, however, much more copper hydroxide can be dissolved. The solvent action of solutions of the "cuprammonium" and the copper-ethylenediamine complexes on cellulose is also discussed in the light of these experiments and an explanation is given of the fact that glycerol will precipitate cellulose from such solutions. The formation of alcoholates, however, does not explain the whole of the solvent action of cuprammonium on cellulose. The degradation of cellulose which precedes dissolution is still obscure, but is apparently a special property of the copper complexes, since ammines of other metallic hydroxides, although capable of alcoholate formation, cannot dissolve cellulose. —J. C. W.

Lignin; Solution of——in Sulphite Liquor. P. Klason. Chem. Zentr. (from Svensk Kem. Tidskr., 1921, **33**, 141-150), 1921, IV., 1112.

In the isolation of cellulose from wood, the dissolution of lignin in the sulphite liquor follows the same laws as the inversion of sugar. The velocity of the reaction is influenced by the hydrogen-ion concentration. Sulphurous acid is the only acid which can be used in the isolation and estimation of cellulose from wood. Other acids convert the lignin present into a modification insoluble in the sulphite liquor. —J. C. W.

Wearing Fabrics; Thermal Conductivity of——. Emily S. Rood. Phys. Review, 1921, **18**, 356-361.

Measurements of the conductivity of knitted and woven cotton, woollen, linen and silk materials have been made by the disc method of Lees, corrected for variation of emissivity with temperature. Practical details of the experiments are given. The values obtained are greater for dense than for loosely woven or knitted samples, and range from 76 for unspun silk, 94–120 for wool, 101–122 for silk, 131 for flannelette, 158–167 for linen, and 168–184 for cotton (each x 10^{-6}). The results are greater for several layers than for a few, and greater for moist samples than for dry. When the materials are arranged according to conductivity for equal weight instead of equal thickness, the order depends largely on the looseness of texture, beginning with unspun silk, loosely-woven wool and knitted artificial silk, and rising to closely woven silk, cotton and finally linen. —J. C. W.

Pectic Substances in Plants. D. H. F. Clayson, F. W. Norris, and S. B. Schryver. Biochem. J., 1921, **15**, 643-653.

The authors describe a preliminary investigation of the chemical constituents of the cell walls of plants, examining particularly the relationship between pectinogen and pectin and the form in which pectic substances are combined in the plant tissues. The isolation and properties of "cyclopectans" and "cyclopectic acids" are described. —J. C.

Pentosans; Estimation of——. A. R. Ling and D. R. Nanji. Biochem. Jl., 1921, **15**, 466-468.

The method described is based on the fact that the addition of four or more equivalents of iodine to one of phenylhydrazine produces iodo-benzene, hydriodic acid and nitrogen. The substance is distilled with 12% hydrochloric acid. The prepared distillate is warmed with phenyl-hydrazine and the hydrazone removed by filtration. The excess of phenylhydrazine is estimated by running the filtrate into a 0·1N solution of iodine and titrating the excess of iodine with sodium thiosulphate. A similar estimation is made with the original phenylhydrazine solution and the difference between the amounts of sodium thiosulphate required in the two estimations is equivalent to the furfuraldehyde present. The results obtained for arabinose agree well with those given by the phloroglucinol method. Contrary to the finding of Menaul and Dowell, sulphuric acid cannot be used for the furfuraldehyde distillation.

—J. C. W.

Colour; Measurement of——. A. v. Lagorio. Zeit. Angew. Chem., 1921, **34**, 585-586.

The quantitative measurement of colour according to Ostwald's colour theory is influenced to a considerable extent by the optical properties of the body under examination. The part played by fluorescence and by polarisation in colour measurement, with particular reference to coloured textiles, is discussed. —J. C. W.

Cellulose; Acetolysis of——. K. Hess. Ber., 1921, **54**, 2867-2885.

By the action of acetyl chloride on cellulose the author has obtained a product which appears to be a mixture of two acetylated anhydrobioses. On further acetylation by means of acetic anhydride and sodium acetate the preparation is converted to a single hexa-acetyl-anhydrobiose. This substance possesses many of the properties of the sugars, and at the same time shows considerable resemblance to cellulose, being insoluble in water, but soluble in cuprammonium solution, and possessing considerable adsorptive power for substantive cotton dyestuff. —J. C. W.

Chlorine Dioxide Solution; Application of——. E. Schmidt and F. Duysen. Ber., 1921, **54**, 3241-3244.

A solution of chlorine dioxide in acetic acid can be used to remove incrusting substances from vegetable material. The method is superior to that previously described, in that the incrusting substances are simultaneously dissolved in the acetic acid. Details are given of the acetic acid solution, and of its method of application. —J. C. W.

Vegetable Fibre; Analysis of——. C. G. Schwalbe. Zellstoff und Papier, 1921, **1**, 1-5.

Practical notes on the following are given:—(1) Preparation of the sample; (2) Estimation of moisture by distillation with toluene or xylene; (3) Incineration; (4) Estimation of resin, fat and wax by extraction; (5) Estimation of furfuraldehyde and methylfurfuraldehyde yields; (6) Estimation of pectin by Fellenberg's method.

—J. C. W.

Ingersoll Glarimeter. L. R. Ingersoll. Paper, 1921, **29**, Oct. 26.

The instrument enables the paper-maker to control and standardise the finish of his supercalendered and other products. In principle it depends on the fact that a sheet of glossy paper polarises the light obliquely reflected from it. This degree of polarisation is found to be a very satisfactory measure of the gloss of the surface. The Glarimeter comprises a source of illumination from which the light falls on the paper at an angle of 57°. The reflected light is then analysed with a type of polarimeter by which the proportion of polarised light is simply and accurately measured. —J. C. W.

Tetralene and Decalene; Detection of——. W. Schrauth. Chem. Zentr. (from Farben-Zeit., 1921, **26**, 3045-3046), 1921, IV., 1103.

Tetralene is a benzene derivative whereas decalene is a "benzine" hydrocarbon. They can be detected by means of dracorubin paper (cf. Dieterich's test for benzene and benzine). Tetralene colours the paper brick-red, but decalene leaves it unchanged. Decalene has a lower solvent power than tetralene and is therefore more suited to the needs of the varnish industry. —J. C. W.

Cellulose. F. O. H. Binder. Chem. Zeit., 1921, **45**, 141.

The heat of combustion of cellulose calculated by the Dulong formula is 598 calories lower than the value given by Muspratt. The value calculated by a modification of the Dulong formula is 343 calories higher than Muspratt's value. The author shows how the calorific value can be calculated from a formula for cellulose in which three oxygen valencies are linked to hydrogen and seven to carbon as 4182 calories against Muspratt's experimental value of 4189 calories.

—J. C. W

Centrifugal Filters. H. C. Beckman. Jl. Ind. Eng. Chem., 1921, **13**, 992-994, and T. A. Bryson, *ibid*, 994-996.

The authors enumerate the factors affecting the speed of draining and point out that in centrifuging fine materials the speed should be low at first in order to avoid close-piling of the solid particles. —J. C. W.

Observations on the Resistance of Fabrics to Light. L'Ind. Text., 1921, **37**, 474-476.

A discussion of the general conditions to be observed when testing fabrics for fastness to light. —J. C. W.

Pressboard; Dielectric Strength of——. A. P. M. Fleming and A. Monkhouse. Electrician, 1921, Nov. 25, 672-674.

The following factors are quoted for pressboards of (*a*) wood pulp, (*b*) 90% cotton hard-pressed, (*c*) jute and hemp mixture, hard-pressed, (*d*) cotton and jute mixture, hard-pressed, unglazed, and (*e*) cotton and jute mixture, lighter than (*d*):—(1) B.D.V. in volts/mil, in oil, after drying at 105°C; (2) B.D.V. in air, after drying at 105°C; (3) Density; (4) Tensile strength, with grain; (5) Do., across grain; (6) Percentage absorption by weight after 24 hours in water; (7) Minimum bend without crack on ⅛" sample after 24 hours in transformer oil at 100°C. It is found that the dielectric strength of pressboard is directly proportional to the density, and that the porosity or ability to absorb liquids varies inversely as the density. The exact nature of the relationship between porosity and density, however, depends on the finish and mode of pressing. Jute boards are most absorbent. Cotton boards are soft, porous, and very pliable and have a high dielectric strength. Material (*d*) is very good and suitable for washers, &c., whilst (*e*) is better for transformer work, where it is desired to immerse in oil without previous oil boiling. Materials (*c*), (*d*), and (*e*) are made by B. S. and W. Whiteley under the name "Elephantide," 1, 2, and 3. —J. C. W.

Effect of the Presence of Filter Paper on Permanganate-Oxalate Titrations. S. G. Simpson. Jl. Ind. Eng. Chem., 1921, **13**, 1152-1154.

Investigating the effect of the presence of filter paper on permanganate-oxalate titrations, the author finds that the reduction of potassium permanganate by filter paper increases rapidly with the first few drops of excess permanganate and in the first moments of contact. Except where great accuracy is required satisfactory results may be obtained either by previously adding a small amount of manganous sulphate and titrating slowly or by washing most of the oxalate from the paper with hot water and adding the paper when the titration is nearly complete. Satisfactory results cannot be obtained in any case where the filter paper is present in highly disintegrated form. —J. C. W.

Testing Machine; A New——. Text. World Jl., 1921, **60**, 3006.

A new Scott tester for textile fabrics is described and illustrated. The machine is of the "constant rate of load" type, the weights being applied by the operation of an inclined plane. Strength and stretch are recorded and charted automatically. Machines can be constructed on the present pattern for very heavy tests in which the weights may be tons, or for tests on single fibres. —J. C. W.

Filter Cloth. See Section 3C.

Measurement of Breaking Stresses, Extensibilities and Elasticities of Single Fibres of Cotton, etc. See *Jl.* Trans., 1922, **13**, 17.

The Chemical Constituents of Raw Cotton. See *Jl.* Trans., 1922, **13**, 1.

Microscopic Diagnosis of the Cotton Species. See Section 1C.

7.—BUILDING AND POWER.

(A)—CONSTRUCTION OF BUILDINGS.

Spinning Mill at Wortley. Ferro-Concrete, 1922, **13**, 189.

Describes and illustrates a two-storey mill of ferro-concrete "daylight" construction built for a Leeds firm. It is 140ft. by 58ft., and the flat roof is 24ft. above ground level. The interior is remarkably free from obstruction, there being only one row of pillars, on both sides of which beams of 29ft. span carry the upper floor and the roof. The walls are mainly windows, and the roof is provided with lantern lights 14ft. wide extending from end to end. —V. M.

(C)—POWER.

Boiler Plant Efficiency. Victor J. Azbe. Mech. Engineering, 1921. **43**, 722.

Test figures are given to show what low boiler efficiencies are being obtained in actual practice and what remarkable improvements can be effected. Emphasis is laid on the necessity for ample combustion space in order to prevent the escape of unburnt gas and the formation of soot and to facilitate operation with the least amount of excess air. The largest preventible loss is due to excess air, and determination of this loss by the measurement of CO_2 and flue gas temperature has become popular. It is, however, commonly considered that 100% excess air is satisfactory, whereas with properly designed furnaces and combustion chambers it is possible to work with 25% excess air and to maintain the CO_2 at about 16%. The effect of flue gas temperature on efficiency and the value of the economiser is dealt with. The effects of increasing the load on a boiler are enumerated; although some of the effects are undesirable the nett result is generally a gain in efficiency and high boiler ratings are recommended.

—V. M.

Chart for Measuring Tension in Leather Belts. W. F. Schaphorst. Engineering World, 1922, No.53, 17.

To determine the tension in horizontal or nearly horizontal belts, it is only necessary to measure the span of the belt, between centres and the sag of the belt in the middle; the latter measurement can be easily made by sighting across from pulley edge to pulley edge. A chart is given from which the belt tension can be read when the above two measurements have been made. —V. M.

Variable-speed A.C.-Commutator Motor; Application of——. R. A. Jones. Gen. Elect. Review, 1921, **24,** 921-934.

A discussion of the theory, construction, and applications of the polyphase A-C. series brush-shifting motors, types BTS and BQS. The efficiency of these motors is compared very favourably with that of the step-ring polyphase induction motor, which is the only alternative to their use for machines which require speed variation at constant torque. The various types of control are described, and examples of the application of such motors to fans, pumps, spinning frames, cloth-printing machines, etc., are given. The single-phase A-C. brush-shifting motor, type BSS, is discussed in a similar manner. Numerous diagrams and photographs are reproduced. —J. C. W.

The Utilisation of Exhaust Heat from Internal Combustion Engines. Engineering World, 1922, No.53, 18.

A lecture by Major W. Gregson is reported, describing the development of waste heat boilers for use in conjunction with internal combustion engines. The great difficulty with such boilers has been corrosion due to the combined action of the gases and moisture. This takes place particularly during the period of sweating when getting up steam, but also when the temperature at the outlet end of the boiler falls too low, due to the load on the engine being low, or when there is any weeping at the tube plates. The corrosion problem has been solved in the modern waste heat boiler by adopting the principle of the Bonecourt boiler in which the fire tubes are packed with refractory material, and are larger in diameter and shorter in length than is the case with ordinary fire tube boilers. Besides getting over corrosion troubles, the modern waste heat boiler lends itself well to easy cleaning of both water and fire surfaces and has a high efficiency. In practice with small and medium sized engines 2·4lbs. of steam from and at 212°F. can be evaporated per B.H.P. The commonest uses to which this steam is put is for blowing gas producers, factory heating, and for process work. —V. M.

Cellulosic Materials; The Hydrolysis of—. See Section 6.

Frankfurt International Fair; Motor Seating. R. Cronauer. Textilberichte, 1921, **2,** 418-419.

A description of a new motor seating for electrically driven machines is given. The motor rests on a sprung foundation, and the tightness of the driving band may be altered by adjusting a balancing weight. The advantages claimed are (*a*) absence of thrust and vibration; (*b*) uniform power transmission; (*c*) 20% economy of current. —J. C. W.

(G)—HEATING.

Constant Temperature Rooms. E. G. Hastings. Jl. Ind. Eng. Chem., 1921, **13,** 1056-1057.

Gas and steam heating systems for constant temperature rooms are described, and thermograph records are reproduced. The Roux bimetallic regulator is recommended. —J. C. W.

9.—COMMERCE, ECONOMICS, LABOUR, ORGANISATION, COSTING, &c.

Silk Mill Costs. Posselt's Text. Jl., 1921, **29,** 71.

In the cost items of a warp are found:—Raw material; throwing; dyeing; winding; warping; beaming; twisting; weaving. Overhead charges are described as being the most difficult to properly allocate. They include:—Manufacturing expenses (salaries, unproductive labour, rent, depreciation, repairs, fuel, current, rates, insurance, general expenses); administrative expenses; taxes and interest. The allocation recommended is on the loom-hour basis, i.e., number of looms multiplied by the maximum working hours per stated period. All loom stoppages—normal or special—are recorded. Allowance must be made for slow difficult jobs compared with fast easy ones. —F. G. P.

Japanese Textile Industry. Times Trade Supp., 1921, **9,** 307.

Twenty-five years ago the value of cotton tissues exported from Japan amounted to only 2,224,000 yen. In 1920 the total had risen to 334,966,000 yen. Japan's chief foreign customer is China. In the latter country, however, a great increase has taken place in the establishment of mills for the spinning of yarn and weaving of cotton fabrics, and the writer raises the question whether the prospects for the Japanese weaving industry are as rosy as the superficial observer might think. The unionism of workers in Japan and the consequent enforcement of much higher wages, combined with less efficiency, may prevent Japan from maintaining the position she has attained in the textile industry. It appears that the Japanese domestic woollen cloth industry is increasing rapidly. A table is given showing the total number of woollen textile factories in existence in Japan, with the number of spindles and looms set up therein and the estimated production for the year 1920. —L. M. S.

South Africa: The Mohair Industry. Bd. of Trade Jl., 1922, **108**, 69.

In 1838 a small number of mohair goats were imported into Africa from Angora. Nineteen years later mohair to the value of £10 was exported. By 1887 Africa had become the largest exporter of mohair in the world. In 1912 23,480,000lbs. of mohair was produced in the country, and the average production for the last ten years has been 17,000,000lbs. During the same period Turkey has produced an average of 12,000,000lbs., and the United States of America 4,000,000lbs. The average price of South African "Firsts" rose from 1s. per lb. in 1913 to 2s. 1d. per lb. in 1917. The average price January-July, 1921, was 8¾d. per lb. During 1916-20 buyers kept big stocks under the impression that the Turkish industry had declined, and that Germany and Russia would be heavy buyers directly peace was declared. On the conclusion of the war it was discovered that Turkish flocks had been kept up and considerable stocks of mohair accumulated, and that the financial position of Russia and Germany prevented their becoming purchasers. It is anticipated that many years will elapse before the industry reaches the position it had in 1913. —F. C.

Brazil: The Cotton Industry. Bd. of Trade Jl., 1921, **107**, 634.

The Commercial Secretary to H.M. Legation at Rio de Janeiro, in his report on economic conditions in Brazil, states that there are 242 mills, with a capital of 337,700,000 dollars, employing 110,000 operatives, in the country. The exports of cotton during 1920 amounted to £5,500,000. —F. C.

Trade with the Netherlands East Indies. Sir Walter B. Townley. Jl. Roy. Soc. Arts, 1922, **70**, 174.

As regards textiles, taking a 1,000 kilo unit, the total volume of cotton yarns, bleached and unbleached, cotton piece goods, printed or dyed, including manufactured articles, such as Sarongs, etc., woollens, half woollens, silk and half silk imported, amounted to 26,283 tons in 1918 and to 43,029 tons in 1920. Great Britain and Japan are the chief exporters of cotton goods to the Netherland Indies in almost equal shares, but Holland also figures as a large exporter with articles which are, for the most part, of English manufacture, a considerable proportion of the British export trade passing through Amsterdam houses. The figures of import values given above are for Java and Madura only, and for the other islands cotton goods to the value of 17,866,000 guilders were imported in 1918, and to the value of 56,710,000 guilders in 1920. The Japanese are very keen competitors for this market, but from the latest information received it would appear that British goods are decidedly more appreciated by the native population, who are the principal buyers. —L. M. S.

New Zealand: Wool Production. Bd. of Trade Jl., 1921, **107**, 518.

H.M. Trade Commissioner in New Zealand reports that a more hopeful view of the future of the wool trade is now discernable in that country, although it is realised that a long time must elapse before anything like normal conditions return. The action of the B.A.W.R.A. in fixing minimum prices, and the appointment of a committee which will take similar action with regard to local sales, has given a certain amount of confidence. The local prices of wool fell during the first quarter of 1921, as follows:—Merino, medium to good, December, 1920, 1/6¼ per lb.; March, 1921, 6¾d. per lb. Half-bred, 1/0¾ to 7¾d.; and Cross-bred, 7⅓d. to 3d. The number of sheep in the Dominion has fallen from 25,828,554 on April 30, 1919, to 23,234,000 on April 30, 1921. —F. C.

Woollen Industry of Japan; The——. Jl. Roy. Soc. Arts, 1922, **70**, 184.

Substantial encouragement for development of the Japanese woollen industry is being given by the Japanese Government. The Government itself is a very large owner of the various kinds of machinery used in the manufacture of woollen goods, and this machinery is being loaned out, at a nominal charge, to private undertakings engaged in or taking up the industry. A further measure of help is in the form of exemption from taxation—every new woollen manufacturing enterprise being free from taxation during the period of its first two years' operation. —L. M. S.

10.—MISCELLANEOUS.

Genelite. E. G. Gibson. Gen. Elect. Review, 1921, **24**, 949-951.

Genelite is a synthetic bronze which has 40% by volume of finely divided graphite evenly distributed throughout its mass. In its manufacture the materials are highly compressed without melting, producing a porous material which absorbs 2—3% by weight of oil. A bearing made of this material never seizes, even if the oil supply is cut off for some time, and shows little wear after prolonged use. The alloy is well suited to indirect lubrication, since a sufficient supply of oil may be conveyed to the bearing surface through the material by capillary action. —J. C. W.

X-Rays and Moths. Chem. Tr. Jl., 1922, **70**, 53.

It has been found that X-rays produced from a mercury-vapour filled quartz lamp can be utilised for freeing stocks of materials from the moth plague, treatment of wool or hides with such rays for a few minutes being sufficient to kill all the pests. —L. M. S.

New German Currency Made of Silk. Women's Wear, 1921, **23**, 6.

Certificates of 25 and 50 marks issued by the municipal savings bank of the silk manufacturing city of Bielefeld are printed on a double weave satin material. —F. G. P.

Canada; Imports of Manufactured Silk Goods. Bd. of Trade Jl., 1921, **108**, 493.

Canadian buyers wish to import, wholesale and retail, hose, shirts, underwear, blouses and ribbons. The last is very important, for last year Canada took ribbons to the value of $3,882,000, of which only $635,000 came from England. It is stated that there is room for improvement in packing the goods. —F. G. P.

Economic Aspect of the Boycott of Foreign Cloth; The——. V. G. Kale. Jl. Indian Industries and Labour, 1921, **1**, 426.

By some it is believed that the universal boycott of foreign (which means mainly British) cloth and yarn in India will bring about the political salvation of the people. The writer urges that to boycott foreign cloth without providing a substitute therefor is not an effective way in which to promote the material well-being of the masses. He states that if the movement is intended to rehabilitate the hand-weaving industry, within certain limits, it is undoubtedly beneficial and worthy of support. India must produce a larger quantity of finer raw cotton, and her mills must manufacture this raw material into the kind of cloth that is at present imported. India's capacity to turn out middling and rough qualities of cloth must likewise be increased. The boycott movement, as it is conducted, is not calculated to produce an improved condition of labour in India. —L. M. S.

Problem of Industrial Fatigue in India; The——. G. M. Broughton. Jl. Indian Industries and Labour, 1921, **1**, 458.

The work already done in England on the subject of fatigue is briefly reviewed and the pioneer work done in America is outlined. Mention is also made of the Comité d'Hygiène recently appointed in France to make similar enquiries, and of Dr. Josefa Ioteyko's book which urges the necessity of learning the correct method of work. Some possible lines of investigation in India are briefly outlined. —L. M. S.

The Linen Industry, 1921. Belfast News Letter, 1921, Dec. 1, 5-6.

The exports to the States for November, 1921, were equal to one-fifth of the previous ten months, while those for December promised to exceed those of November. As regards monetary value, the shipments of linen from the United Kingdom for the eleven months ending November 30, 1921, as compared with the 12 months of 1920, show a fall of approximately eleven million pounds sterling. A table is given showing this. In the year 1920 the total yardage was 93 million sq. yds. at an average value of 3/2 per sq. yd. For eleven months of 1921, 34,539,600 sq. yds. at 2/9 per sq. yd. were exported. The imports of flax for 1921, eleven months, were 15,819 tons; 1920, 18,432 tons; 1919, 9,996 tons; 1913, 84,270 tons. The immediate problem in the flax trade is therefore from whence must supplies be obtained in view of the very doubtful recovery of Soviet Russia. —F. B.

Simplicity in Textile Cost Methods. R. E. Loper. Cotton (U.S.A.), 1921, **86**, 84.

The production data should be allowed to lie for awhile and then analysed, when more reliable data results are obtained than by the weekly report system. The costing system must preserve the true relative cost between the styles of cloth being produced in the mill, the overhead costs must be distributed so that each department is made to bear its adequate share, and the accuracy should refer to the period for which sales are contemplated rather than for past sales. —W. D.

Industrial and Commercial Applications of Psychology and Physiology. Charles S. Myers. See *Jl. Proc.*, 1922, **13**, 2.

Argentina: Wool Production. Bd. of Trade Jl., 1921, **107**, 684.

Until the outbreak of war sheep farmers in Argentina concentrated on raising sheep for meat rather than for wool. With the rise in prices 1916-18 wool production became highly profitable, and extravagant hopes were entertained as to the future condition of the wool market. Misled by these hopes growers held up supplies of wool during 1919, with the result that at the end of 1920 the stock of wool in the country was greater than a year's clip. Export duties were removed in January, 1921, and special facilities provided for discounting bills of exchange, but the situation was not materially relieved by these measures. According to statistics given in the report of H.M. Commercial Secretary at Buenos Aires in 1913 32% of the wool exported went to France and Germany, and 6% to the United States. During the war the exports to the latter country increased to 75% of the total exported. In the year 1920-21 Germany resumed her position as biggest customer, and the trade with the United States and France decreased considerably. —F. C.

British India: Import of Textiles, 1920-21. Bd. of Trade Jl., 1921, **107**, 665.

The following figures relating to the import of sewing cotton, flax, jute, silk and woollen manufactures into India during 1920-21 appear in the General Review of the Conditions and Prospects of British Trade in India:—Sewing cotton, £911,968, of which £846,173 came from the United Kingdom; flax manufactures, £603,487, almost entirely British; jute manufactures, £262,878, of which £237,000 came from the British Empire; silk manufactures, £5,444,066, 84% came from Japan and the remainder principally from China and Italy; silk mixtures, £512,314, of which £95,675 came from the United Kingdom, France, Italy, Japan, and Switzerland having the bulk of the trade; woollen piece goods, £4,611,780, the United Kingdom supplying £4,118,698; woollen yarns and knitting wool £247,343, formerly supplied by Austria and Germany, now by the United Kingdom; carpets and rugs, £200,672, of which £132,076 came from the United Kingdom. In every instance the returns for 1920-21 show an increase over the returns for the previous year.—F. C.

ABSTRACTS

I.—FIBRES AND THEIR PRODUCTION.

(A)—MINERAL.

Asbestos Industry in China; The——. Chem. Trade Jl. (from Chamber of Commerce Jl., 1922, **43**, 13), 1922, **70**, 145.

Asbestos deposits have been discovered at Yungyang, in Hupeh; at Yangshan, in the north-western corner of Kwantung, and other districts, but principally in Szechwan, around Powchow and Chengtu, where valuable deposits are said to exist. In Manchuria it is obtained in the Suiyuen district, and three mines are being worked in the Kwantung leased territory, in the south-eastern section of the province, most of the output there being sent to Japan. The deposits in the Philippine Islands are being worked only in a small way. The asbestos found in the Far East is very similar to that found in S. Africa, the bulk being inferior to that of the latter. Most of the Chinese asbestos is deficient in textile strength, but much of the material could be utilised for mixing with better qualities, provided that there is careful selection and treatment. Up to the present, business has been so small that there are no regular market lines. —L. M. S.

(B)—ANIMAL.

Experiments in Breeding Bivoltine Silkworms in Brianza, Italy. D. Podesta. Bull. Agric. Intell. (from Il Coltivore, 1920, **76**, 946-948), 1921, **12**, 348.

Describes experiments with 1oz. of eggs of the " White Japanese " bivoltine breed of silkworms. The development of the worms was irregular, and the spinning results of the silk obtained were unsatisfactory. The eggs were hatched at the end of August, and it is suggested that better results might be obtained if the larvae were hatched earlier, say, from the end of July to the beginning of August. —W. R.

Sheep Breeding in India. Wool Rec., 1922, **21**, 112.

Experiments are being carried out, in the United Provinces, the Punjab, and the North-West Frontier Province, chiefly with the Indian ewe and the Australian merino. The first cross shows a marked improvement in wool. The second cross or three-quarter breds show still further improvement, the wool being longer, finer and softer. With a later cross between the three-quarter breds and the merino a still further improvement in both quality and quantity of wool has been recorded, and by mating graded ewes and rams from this cross it is hoped to maintain the improvement permanently. —F. P.

The Hemipteron Lyryocoris Campestris, a New Parasite of the Silkworm recorded in Italy. Bull. Agric. Intell. (from L'Italia vinicola ed agraria, 1921, **11**, 188), 1921, **12**, 465.

This insect, which lives on poplar trunks and under fallen leaves, attacks the silkworm by rapidly and repeatedly piercing the body. The habits of the insect are being investigated, with a view to devising methods of control. —W. R.

Sheep Breeding in Germany after the War. A. Golf and Kettner. Bull. Agric. Intell. (from Illustrierte Landw. Zeitung, 1920, **41**, 374-376, and Deuts. Landw. Presse, 1920, **47**, 68), 1921, **12**, 461.

Golf deals with measures to be taken for the development of sheep rearing in Germany. He advocates the establishment of syndical sheep farms or sheep grazing syndicates, each owner taking back his animals in the winter and the communal flock being made up afresh in the spring. Kettner describes the working of these sheep grazing syndicates in considerable detail. The activities include the engaging of a common shepherd, the acquisition of good breeding animals, increasing pasturage, collecting subsidies, and the co-operative sale of wool and other products. The methods of breeding are also dealt with at some length, and the necessity for securing a certain amount of uniformity in breeding methods is discussed. —W. R.

Sheep and Goat Breeding and the Skin Trade in Brazil. Guedes, M. Bull. Agric. Intell. (from Cha caras e Quintaes, 1921, **12**, No.1), 1921, **12**, 463-4.

Brazil possesses vast tracts of grazing land, and goat breeding is carried on to a considerable extent by small proprietors. Sheep are not reared to anything like the same extent. The chief products exported are therefore goat skins. —W. R.

Improving the Grade of Western Wool. W. C. McKillican. Dominion Experimental Farms (Canada), Seasonable Hints, 1921, No.21, 7.

The wool from the farms of Manitoba and Saskatchewan sold through the woolgrowers' co-operative organisation and graded by Dominion Government graders has been graded lower than that from other provinces. This is due to poor methods of breeding, feeding, and handling farm flocks. Inferiority is due mainly to an undue proportion of (*a*) " burry and seedy " wool and (*b*) " dark " wool. The latter is the more serious, as " dark " wool means weak wool, caused through poor conditions of growth. Preventive measures are suggested and also recommendations as regards general preparation for the market. —E. A. F.

Merino Sheep: Ancient and Modern. Wool Rec., 1922, **21**, 316-318.
South African growers are endeavouring to increase their wool production. Merino rams of 100 years ago clipped only some 6lbs. of wool; to-day they will clip from 25-30lbs. of wool. Prize-winning sheep in 1828 were without wool on the head and legs, and were quite different in appearance from the sheep of to-day. —F. P.

Silkworm and Mulberry Cultivation. Posselt's Text. Jl., 1921, **29**, XX.
The authorities of Chihli, China, are encouraging sericulture. Owners of a certain limit of land are required to plant a definite number of mulberry trees. Seed is supplied free, and cocoons are to be purchased at market rates and sent to the filatures. —F. G. P.

Wild Silk Industry in Manchuria. Posselt's Text. Jl., 1921, **29**, XXIV.
Scarcely a village in Manchuria is not producing wild silk, the yearly output being about 30,000,000lb. —F. G. P.

Wool in Shantung. Posselt's Text. Jl., 1921, **29**, No.6, IX.
Tsingtao is gradually becoming a centre of wool exportation, with Japan as principal importer. The producing districts are along the Shantung Railway, the best being Chingchow, Tzechwan, Poshan, Chowtsang, and Ankiu. In the western part of the province Lintsing, Tungping, Taian, Mengyin, and Yichow are the wool producing districts. No reliable statistics on the provincial output are available, but, calculating on the number of sheep raised in the province, exports of the last few years, and the local consumption, the following figures are approximately indicative of the present trade:—Average annual production, 1,000,000 catties (1 catty=1⅓lbs.); local consumption, 200,000 catties; exports (Tientsin), 450,000 catties; (Tsingtao), 350,000 catties. The number of sheep in Shantung is stated to be about 500,000, each of which is supposed to yield two catties of wool in two shearings every year. Wool is locally consumed for the manufacture of hats, soles, rugs and socks. The output of the several producing regions is given, taken from the Journal of Wool and Hides (Chinese).—L. M. S.

Wool Analysis of a Flock of Highland Blackfaced Sheep. See This *Jl.* (Trans.), 1922, **13**, 40.

Wool; Judging the Fineness of——. See Section 6.

(C)—VEGETABLE.

Belgian Congo; Trade of the——. Jl. Roy. Soc. Arts, 1922, **70**, 232.
It is stated that experiments in cotton culture have met with very good success, the production in 1920 being estimated at 4,000 bales of 550lbs. each. —L. M. S.

Flax Seed Testing in Ulster: Supply Prospects. Belfast News Letter, 1922, Feb. 21, 6.
With the functioning of the Northern Parliament of Ireland the Government naturally took immediate steps to obtain all possible information for obtaining the necessary supplies of flax seed for sowing in the spring of 1922, and also for testing the same for purity and germination. A station for the testing of flax seed is shortly to be established in Ulster, and meanwhile any testing will be carried out in Dublin as heretofore. The available supplies of flax seed for 1922 are, briefly: Dutch, Canadian, English, and Riga. In Holland the area under cultivation for 1921 was less than one-half the area sown in 1920. Owing to the severe drought during last summer the quantity of seed now available is not only relatively small, but the plumpness and weight of the seed are less than normal, though the germination is satisfactory. In Canada the area under flax in 1921 was about one-fifth of the acreage of 1920. The crops of flax and yield of seed were below the average, and consequently the amount available for export is also small. In England the area under flax in 1921 was 1,200 acres, as compared with 10,000 for 1920. The harvesting facilities were good generally speaking. The seed, though small in quantity, is of good quality. High-grade qualities of flax seed from any source are very scarce this season. —F. B.

Susceptibility of Flax to Lime. P. Liechti and E. Truninger. Bull. Agric. Intell. (from Deutsch Landw. Presse, 1920, **47**, 65), 1921, **12**, 315.
Describes experiments carried out near Berne, Switzerland, with a sandy clay soil, poor in lime. The lime had harmful effects on growth, and retarded flowering and prevented fruiting or even induced apical necrosis. The authors are unable to explain these effects of lime on flax. —W. R.

Earias insulana, var. anthrophilana a Macrolepidopteron Parasitic on the Cotton Plant and on "Gombo" (Hibiscus esculentus) in Cyrenaica. V. Zanon. Bull. Agric. Intell. (from Revista di Agricoltura, 1921, **26**, 23-24), 1921, **12**, 369.
The caterpillars injured the fruit both of the cotton and Hibiscus, so that the crop was considerably damaged in 1919. In Cyrenaica there are two generations of *E. insulana* on the two host plants in one season, and there may even be a third on Hibiscus. In Upper Egypt it is held advisable to keep all Malvaceæ as far as possible from cotton plantations, but the author suggests the sowing of *H. esculentus* very early near the cotton fields, for since its fruits are earlier and more tender than cotton it would attract the first generation, and then after the moths have laid their eggs all the "gombo" fruits should be gathered and the plants pulled up. —W. R.

Agricultural Possibilities in Ceylon: Fibres. Bull. Agric. Intell. (from Tropical Agric., 1921, **56**, 1-2), 1921, **12**, 376.

Sisal has been demonstrated to be a crop with possibilities for the dry zone of Ceylon, and a syndicate has undertaken the cultivation of this fibre, which together with *Furcræa*, also affords good prospects for the small cultivator. —W. R.

Cotton Growing; Improvements in——. O. F. Cook and W. A. Taylor. Text. World, 1922, **61**, No.5.

As a result of the spread of boll weevil pest the growing of cotton has been abandoned in a few of the more humid districts of the States, but more cotton is being grown in the drier regions of Central and Western Texas. The cultural qualities most prized in weevil infested areas are early and rapid setting of the crop on small, upright, single stalk plants, resistance to disease or insect pests, large bolls, the holding of the cotton in the open bolls, and the so-called storm-proof character. —W. D.

Cotton Diseases in Sao Paulo. Experiment Sta. Rec. (from Bol. Agr. Sao Paulo, 1920, **21**, 227-291), 1921, **45**, 649.

An illustrated account of the fungal diseases of cotton in Sao Paulo. —W. R.

Flax Diseases. J. Westerdijk. Experiment Sta. Rec. (from Jahresber. Ver. Angew. Bot., 1918, **16**, 1-8), 1921, **45**, 649.

Gives notes on recent information regarding flax smut (*Asterocystis radicis*), rust (*Melampsora lini*), anthracnose (*Gloeosporium lini*), Botrytis rot (*B. cinerea*) and dead stalk (*Phoma sp.*) of flax. —W. R.

Jute Chlorosis. G. P. Hector. Experiment Sta. Rec. (from Agric. Res. Inst. Pusa. Sci. Rpts., 1919-20, 55-57), 1921, **45**, 649.

Chlorotic plants never breed true, but always throw greens. Green plants breed practically pure, but throw a small inconstant percentage of chlorotics. By constant selection the proportion of either chlorotics or greens can be increased, but no absolutely pure race has ever been obtained. It is suggested that the disease is inherited via the cytoplasm of the egg cell. The work is still in progress, and is being extended to other crops.—W. R.

Algerian Exports: Position of Cotton-Growing. Times Trade Supp., 1922, **9**, 446.

New efforts are now being directed to cotton cultivation, which since the war has been rather neglected. The results obtained at the experimental station at Terme-Blanche, near Orléansville, are given:—The ginning of the crop produced 110,000 kilos of pure cotton in 1918, 90,700 kilos in 1919, and 240,000 kilos in 1920. The export of cotton from Algeria during the last season rose to 2,502 quintals, valued at 3,752,000f. —L. M. S.

Breeding of Wilt-resistant Cotton in Alabama. H. B. Tisdale. Experiment Sta. Rec. (from Alabama Col. Sta. Circ., 1921, No.44, 16, 17), 1921, **45**, 38.

Names the leading wilt-resistant varieties of cotton as determined by tests on wilt-infected land in Alabama. It is shown that by planting cotton rather thickly on wilt-infected soil and thinning later than usual the weaker plants die before thinning, thus giving better stands of cotton than are obtained by the usual methods. —W. R.

Paraguay: The Cotton Industry. Bd. of Trade Jl., 1922, **108**, 160.

Attempts are being made to extend the cultivation of cotton crops in Paraguay. The results up to the present have been encouraging, the cotton raised having been of fine quality. H.M. Counsel at Asuncion anticipates that before long cotton will be an important article of export from Paraguay. —F. C.

Cotton Crops in British India. Bd. of Trade Jl., 1922, **108**, 112.

The Government of India has issued the following statement as to the cotton crops of British India:—The yield of ginned cotton in 1921 is estimated at 785,600 metric tons, against 658,100 metric tons in 1920. The area cultivated in 1921 was 17,855,000 acres in 1921 and 19,710,000 acres in the previous year. —F. C.

Cotton; Diseases of the Vegetative or Reproductive Systems of——in Sao Paulo. R. Averna-Saccá. Experiment Sta. Rec. (from Bol. Agr. Sao Paulo, 1920, **21**, 293-311), 1921, **45**, 649.

An account of diseases of cotton, including gummosis (bacterial) connected with *Pleospora gossypii* (*Alternaria tenuis*) and a discussion of protective methods. —W. R.

Preservation of Canvas Sacks Intended for the Reception of Products Used in Agriculture. See Section 6.

Culture of Flax in Ireland. See This *Jl.* (Proc.), 1922, **13**, 33.

Vegetable Fibres other than Wool and Cotton. See This *Jl.* (Proc.), 1922, **13**, 29.

(D)—ARTIFICIAL.

Artificial Silk-Making Improved. Posselt's Text. Jl., 1921, **29**, No.6, VII.

German makers are producing flakes instead of continuous threads; these can be spun into fibres as are cotton flakes. The cellulose solution is squirted into the stiffening liquid in opposite directions from two sets of very small spinnerets; at the point of contact the two streams flatten into flakes. A bulkhead of metal or glass serves the same purpose. It is claimed that fibre spun from flakes is less hygroscopic and more homogeneous than threads. —F. G. P.

Artificial Silk Manufacture; The Scientific Basis of——. See Section 6.

Development of Artificial Silk in America. See Section 9.

PATENTS.

Cotton Picking Apparatus. Alleyne D. Alvin, San Antonio, Tex., Assr. of one-half to F. M. Mueller. U.S.P.1,396,012, Nov. 8, 1921. Appl. 9/7/20. (7 claims: 1 printed.)

The apparatus comprises wheels, a chassis supported by the wheels and vertically adjustable thereon, with frames supported for swinging movement on the chassis. Pneumatic conveying means are associated with the cleaning rollers. —T. W.

Hulling and Cleaning Feeder for Cotton Gins. James M. Peerson, Florence, Ala. U.S.P.1,396,142, Nov. 8, 1921. Appl. 19/3/20. (15 claims: 13 printed.)

The gin feeder and cleaner has a casing with a top cotton inlet and bottom outlets for hulls and cotton. Picker rolls co-act with the feeder roll between the brush and picker ribs and adjacent to the hull outlet. —T. W.

Cotton Lint Collector. Arthur Stables, Los Angeles, Calif. U.S.P.1,396,673, Nov. 8, 1921. Appl. 27/11/20. (2 claims: 1 printed.)

Comprises an endless moving screen mounted on compressing rollers, means for collecting lint between the flights of the screen, and an offtake from the screen arranged to receive the compressed lint after passage over one of the rollers. —T. W.

Cotton Separator. James C. Garner, Houston, Tex., Assr. to Garner Gin Co. U.S.P.1,397,001, Nov. 15, 1922. Appl. 7/8/17. Renewed 7/1/21. (6 claims: 1 printed.)

Comprises a rotary foraminous drum having a cylindrical wall permeable to air, with arrangements to conduct the air continuously outward through the ends of the drum; a discharge passage for material collected on the drum, and intermittently operative means for closing an outside duct against the passage of air through the drum. —T. W.

Cotton Cleaner and Boll Breaker. Grover C. Stacy, Dallas, Tex. U.S.P.1,397,257, Nov. 15, 1921. Appl. 19/2/20. (17 claims: 16 printed.)

A screen bed for cotton cleaners has foraminous material covering and following the curvature of its sides. —T. W.

Cotton Picking and Cleaning. George R. Bennett, Glen Osborne, Pa. U.S.P. 1,398,930, Nov. 29, 1921. Appl. 15/11/20. (16 claims: 1 printed.)

A method of removing the lint from a boll by a rapidly moving stream of air, causing the gather of lint to move laterally from the air stream. —T. W.

Boll-weevil Eradicator. George W. Mobley, Waynesboro, Ga. U.S.P.1,398,599, Nov. 29, 1921. Appl. 20/5/21. (1 claim: 1 printed.)

Comprises a portable body, brushing medium, a trough positioned below the body, flexible members connecting the trough and body, and links pivotally connecting the trough and body. —T. W.

Artificial Silk; Manufacture of——. E. Bronnert. E.P.170,313, Oct. 19, 1921 (Appl. No. 12,972/20) and 170,874, Oct. 31, 1921 (Appl. No. 12,051/20).

According to the first patent saturated common salt solution or "Stassfurt waste salt," with addition of sulphuric acid, is used as precipitating bath for viscose. Strong, lustrous, evenly-dyeing threads result. In the second patent solutions of bisulphites are used for very fine threads of viscose. A solution of 360 grams sodium bisulphite per litre is used for producing 2 denier threads; 1—1·5 denier threads are produced in a saturated bath of the ammonium salt at 80°C., with a long travel at the rate of 40 metres per min. —F. G. P.

Cellulose Butyrates: Plastic Compositions, etc. A. D. Little. E.P.161,564, Conv. April 10, 1920.

Cellulose butyrate is prepared from cellulose by treatment with butyric anhydride in the presence of butyric acid and a catalyst such as sulphuric acid. The ester is soluble in a number of organic solvents. It may be used in the manufacture of plastics, transparent sheets and films, artificial silk, lacquers, dopes and artificial leather. —J. C. W.

2.—CONVERSION OF FIBRES INTO FINISHED YARNS.

(A)—PREPARATORY PROCESSES.

Production of Mixtures. Spinner und Weber, 1922, No.3, 1.

Medium length, staple wool should be used. If long wool is desired, this should be used for the "ground" colour and short wool used for the added colouring. Lamb's wool on tops cut into short lengths is frequently used. —H. R. H.

Why Reelers Propose 14/16 Standard. K. Isome. Silk (N.Y.), 1922, 15, 48.

The present 13/15 denier standard for silk fibres was set when the native Japanese cocoon was small, pea-nut shaped, with short fibre and unsuitable for quick reeling. When foreign seed was admitted in 1916 and crossed with the native, the cocoons became larger, round, and the fibres longer and not only stronger but also coarser. The result is that the fibres of only four cocoons go to the 13/15 deniers. If, as often happens, one or two of these break, spinning goes on for some time with a very fine thread which gives rise to claims. It is suggested that 14/16 denier will tend to avoid such important unevenness. —F. G. P.

Cotton Mill Organisation. G. F. Payne. Textile World, 1922, **61**, 31.

The machinery at present used in cotton mills for opening cotton could be greatly improved upon. A new air blowing system with as few blows of a beater as possible would retain fibre strength and the air system would open and remove the foreign matter from the cotton; this would eliminate intermediate pickers and take material direct from breaker to finished lapper. The slubbers should not be drafted over 3, and a slubber hand should run three machines with 12 by 6 in. bobbins; first intermediates should not be drafted over 3½ with 10 by 5½ in. bobbins. Second intermediates should not be drafted over 4, nor speeders over 5. All weft should be re-wound on to not less than a 9 in. shuttle bobbin. To have spoolers running at 1,200 revolutions per minute with the latest improved tension device would reduce the number of spindles required by over 50%. —W. D.

Top Roll Covering. Posselt's Text. Jl., 1921, **29**, 76.

Sheep skin is specially suitable for covering top rollers in yarn preparing machinery on account of its regular surface and elasticity. The grain side of the leather should be smooth, firm and pliable, and the inner side should have the same feel as a kid glove. The larger skins are used for drawing and slubbing rollers, the medium skins for intermediate and roving frames, and the small skins for the spinning frames and mules. Heavier cloth is put on rolls for drawing and slubbing as on fine spinning frames, and this cloth should be made of well-carded wool. —W. D.

The Legal Requirements in the Equipment of Worsted Combing and Spinning Mills. See This *Jl.* (Proc.), 1922, **13**, 13.

(B)—Spinning and Doubling.

Artificial Silk Spinning: Collodion Silk. Posselt's Text. Jl., 1921, **29**, 123.

The plant should be in duplicate, so that the filtered solution may be passed to the spinning press while another batch is being prepared; work should be continued night and day. The liquid flows by gravitation to the spinning press and compressed air used as little as possible because it does not improve the solution and the loss of ether is reduced. Spinnerets of glass are set in copper tubes, with bobbins over each to receive the thread. The speed of the bobbins needs very accurate adjustment to avoid straining or thickening of the fibre; the extrusion pressure is 40-45 atmospheres. Suitable guides for laying the fibre on the bobbins regularly are required. The lustre of the fibre is said to be increased by the fact that in drying it loses its cylindrical form and becomes partially flattened and distorted. The speed of spinning is about 40 metres per minute. The dry weight of 1,000 yds. is 0·35 to 0·40 dram; eight fibres are reeled together generally, giving a denier weight per 1,000 yds. of 47·6. For embroidery and other heavy goods threads of 8—16 fibres are doubled or trebled. The principal causes of faults are:—Improper ventilation, slow speed in taking off, too great pressure, too large spinnerets, bad solution. —F. G. P.

The Legal Requirements in the Equipment of Worsted Combing and Spinning Mills. See This *Jl.* (Proc.), 1922, **13**, 13.

Cotton; Preliminary Manufacturing Tests of the Official Cotton Standards of the United States for Colour for Upland Tinged and Stained——. See Section 6.

Individual Motor Drive for Spinning and Twister Frames. See Section 7C.

Silk Throwing and Electric Drive. See Section 7C.

Top Roll Covering. See Section 2A.

(D)—Yarns and Cords.

Embroidery Yarn. Posselt's Text. Jl., 1921, **29**, 86.

These yarns are spun soft in order to fill up the design with the least number of stitches, and they are usually made of long-stapled cottons and in 3, 4, 5 or more ply. Most of the yarns are combed and made of Egyptian cotton, the main counts used ranging from 40/2's to 120/2; in exporting to the American market it is an advantage to send the yarn counts as low as possible so that they may have less duty to pay. Yarn for use on the hand embroidery machine must have greater tensile strength and it is supplied in lengths of about 40 in., each length being inserted back and forwards in the cloth until it is used up. Hard twisted yarn curls up and makes a cord or loop which may not open up again when the yarn is pulled tight. The Bonnaz embroidery machine uses 8/2's yarn counts up to 20/2's, whilst for hand embroidery the usual counts are 10/3's up to 60/4's. —W. D.

Harness Twine. Posselt's Text. Jl., 1921, **29**, No.6, XX.

It is estimated that two-thirds of American looms are still equipped with twine harness, the annual consumption being from 300,000 to 400,000 lbs. It is mostly made in America, but up to 60,000 lb. is imported. The finer twines, 130/9 and 140/9, are mainly imported for the silk industry and for harnesses for looms for ribbon or warp-dyed broad silks. Polished twines last longer and are put in "French" harness; unpolished twines are made into "English" harness. Imported twines are 6, 9, or 12 ply cabled yarns. A very small quantity of larger partly made twines is imported. Harness twines are firm, smooth, tough and round, made of long staple cotton, sea-island or Egyptian. —F. G. P.

Silk Yarn Tables. A. L. Dorgin. Amer. Silk Jl., 1922, **41**, Supplement.

Comparisons are given of gum yardage with boil-off yardage for various denier thread in Japan, Tsatlee and Tussah silks, also yardage for artificial silk and spun. Another table gives comparative weights and lengths of silk in gum, boiled-off, spun silk, cotton, worsted, wool, and linen. There is also a parallel table for hosiery, giving artificial silk, thrown silk, and cotton or spun silk singles. —F. G. P.

The Stress-Strain Curves of Various Yarns. See This *Jl.* (Trans.), 1922, **13**, 25.

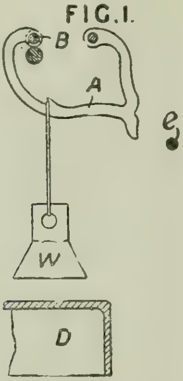
The Elastic Properties of Yarns. See This *Jl.* (Trans.), 1922, **13**, 45.

PATENTS.

Combing Machines. Fine Cotton Spinners and Doublers' Assocn., Ltd., and R. L. Bellhouse. E.P.171,650, Nov. 24, 1921. (Appl. No. 8201/21.)

The top detaching roller B of a Nasmith machine is weighted by a weight W suspended directly from the carrying lever A. The weight may hang above the beam D or be drawn to one side by a cord from an arm on the shaft *e*. —T. W.

FIG.1.



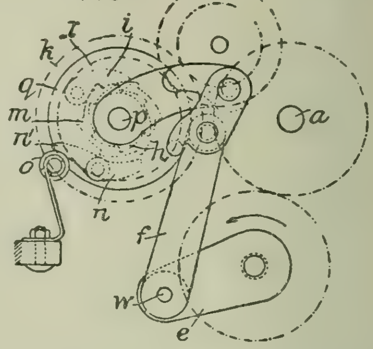
Artificial Filaments. W. P. Dreaper, London. E.P.171,719, Nov. 28, 1921. (Appl. No. 14314/20.)

A continuous stream of water or other liquid passes through a funnel or guide that leads the thread from the godet to the centrifugal spinning box; this stream facilitates the running of the thread through the funnel, and enables a finer thread or a weaker thread to be spun at a higher speed than usual; also, by a suitable choice of liquid, a desired chemical or physical modification of the thread may be obtained. The jet of liquid may, if desired, be arranged to meet the thread before the latter enters the guide so that the thread is weighted and caused to pass through the guide without handling; or, the jet may be arranged to touch the thread as it leaves the surface of the godet. —T. W.

Combing Machines. P. A. Helmbold, Vohwinkel, near Elberfeld, Germany. E.P.171,826, Dec. 1, 1921. (Appl. No. 26454/20.)

The driving arrangement for the drawing-off roller (Heilmann type) comprises gear wheels *k*, *r*, mounted loosely on an oscillating shaft *p* and actuated through ratchets *h*, *m* to give the faster and longer forward movement and the slower backward movement. The shaft *p* is oscillated by a crank *e* driven from the comb shaft *a*. The pawl *i* is carried by the gear *k* and engages the ratchet *h* to give the forward movement. The pawl *n* is carried by a disc *q* on the shaft and engages the ratchet *m* to give the backward movement. The pawl *n* is held out of gear during the forward movement by a spring bowl *o* engaging a tail *n'* on the pawl. The connecting link *f* is in two parts pivoted together so that when the crank pin *w* is rising there is lost motion to give a stationary period in the movement of the drawing-off roller. —T. W.

FIG 1



Thread Breaking Device for Spinning Machines. Ferdinand Q. Hartman, Danville, Pa. U.S.P.1,397,283, Nov. 15, 1921. Appl. 31/5/18. (4 claims: 2 printed.)

For spinning machines in which several threads are independently spun and wound on a single take-up spool, the device comprises thread guide levers each pivoted in position to drop when its thread breaks; a counterbalanced thread breaker pivoted to swing into position to break a thread, the breaker being located in position to be thrown off centre by the dropping of a thread guide lever, and manually-controlled means for temporarily locking the breaker in inoperative position. —T. W.

Spinning: Coilers. R. Waller and D. Whitehead and Sons, Ltd., Rawtenstall, Lancs. E.P.172,402, Dec. 5, 1921. (Appl. No. 25492/20.)

The top of a coiler is provided with two clearing rollers mounted in brackets pivoted to the coiler top. The smaller roller is of light weight and is rotated by contact with the sliver. The larger roller is preferably covered with cloth and is rotated by the smaller roller. —T. W.

Spinning or Winding Machine. Alonzo E. Rhoades, Hopedale, Mass., Assr. to Draper Cor. U.S.P.1,397,905, Nov. 22, 1921. Appl. 11/1/21. (13 claims: 1 printed.)

Yarn guiding apparatus comprising means for guiding to receivers, a builder arm, connections between the arm and yarn guiding means, including two flexible portions, both of which are connected to the let-back mechanism; a detector movable synchronously with the let-back mechanism, and about which one of the flexible portions passes between its connections with the let-back mechanism and yarn guiding means, and means for operating the let-back mechanism and deflector. —T. W.

Bobbin-holder. Albert Henry Fleck, Lakewood, Ohio. U.S.P.1,397,927, Nov. 22, 1921. Appl. 17/12/20. (4 claims: 3 printed.)

A conical cop-tube support comprises a supporting arm, a supporting base thereon, with spindle on base. A threaded cone-shaped support is provided with a supporting head having a threaded opening and a sleeve clamping screw surrounding the spindle in co-operative relation to the threaded cop-tube support. —T. W.

Roller Heads for Spinning Frames. H. Tschudy, Ennenda, Switzerland. E.P. 172,286. (Appl. No. 28572/21.) Conv. Dec. 1, 1920.

The pressure roller is weighted by a heavy clearing roller resting upon it. The latter roller is covered with cloth and is mounted in a U-shaped metal guiding member which is adjustably fixed to a side plate of the framing and has a forked arm for supporting the clearing roller when not in use. The guiding member is fitted with an adjustable supporting screw. The clearing roller may be arranged to rest on two pressure rollers. —T. W.

Card Feeder. Joseph B. Howe, Worcester, Mass., Assr. to G. S. Harwood and Son, Boston. U.S.P.1,399,557, Dec. 6, 1921. Appl. 13/12/20. (12 claims: 9 printed.)

Comprises fibre elevating mechanism, an oscillating doffer, and actuating means therefor. —T. W.

Machine for Unravelling Knitted Goods and Winding the Yarn. Michael F. Robischon, Utica, N.Y. U.S.P.1,399,657, Dec. 6, 1921. Appl. 15/9/19. (12 claims: 1 printed.)

The machine has a plurality of feeds, the combination of a thread-drawing unit for each feed of the knitted goods, each drawing unit comprising a movable thread-engaging member, having at different parts thereof different drawing speeds. A rack is provided for holding the fabric to be unravelled and means for obtaining relative movement between the rack and the rest of the machine whereby the unravelling points on the fabric remain in operative position relative to their respective drawing units. —T. W.

Spinning: Spinning and Twisting Machines; Spindle Apparatus; Spindle-driving Apparatus; Twist Tubes and like Twisters; Doffing Arrangements. W. Binns and J. D. Mander, both of Bingley. E.P.172,343, Dec. 5, 1921. (Appl. No. 15242/20.)

Unspun or partially spun and twisted sliver or yarn from a cop is conducted by an air current through a tube between three sets of drawing rollers and thence through a lower tube, coaxial with and forming an extension of the above-mentioned tube, rotating at from 20,000 to 60,000 r.p.m., from which it is projected by centrifugal force and wound in the form of a hollow cop on the interior of a rotating and reciprocating cap. The yarn may be guided out of the axial path by a partition in the guide tube. A driving wheel is arranged to drive a number of tubes. To doff the cop, a tube or spindle is inserted within the tube nearest the cap, and the latter stopped or slowed down, whereupon the cop contracts on to the spindle or tube. This action may be assisted by a current of air introduced at the top of the cap or issuing from the top of the tube upon which the cop contracts. The lower tube may be withdrawn upwardly from the cap and a spindle inserted and clutched thereto, a cop tube splined on the spindle being then raised into the cap and subsequently lowered when the cop has contracted thereon. —T. W.

Bobbin Stripper. Clarence A. Pierce, Lowell, Mass. U.S.P.1,399,025, Dec. 6, 1921. Appl. 16/5/21. (2 claims: 1 printed.)

The machine has, in combination, a receptacle to contain bobbins to be stripped, a rotatable spindle above the receptacle and adapted to have the yarn ends from the bobbins wound thereon, and a device interposed between the spindle and receptacle to prevent any bobbins which may be lifted from the receptacle from being wound on the spindle.—T. W.

Spools. C. Tellenbach, Buttes, Switzerland. E.P.171,801, Nov. 30, 1921. (Appl. No. 25037/20.)

The flanges of bobbins are each provided with an embossed metal disc having a rim closely engaging the peripheral edge of the flange. The edge of the rim is turned inwards and let in flush with the outer face of the flange. The flanges are secured to the barrel or core by conical stoppers. —T. W.

Spinning Ring Carrier. Thomas Whitehead, Blackpool, England. U.S.P. 1,399,418, Dec. 6, 1921. Appl. 15/4/21. (3 claims: 1 printed.)

A revoluble driving sleeve having an enlargement at its upper end, a carrier provided with a race for a traveller at its upper end, and a reinforcing ring secured to the lower end of the carrier and provided with means for placing it into and out of driving engagement with the sleeve. —T. W.

Flyer for Roving Frames, &c. Leon W. Campbell, Barre Plains, Mass. U.S.P. 1,399,332, Dec. 6, 1921. Appl. 21/12/20. (7 claims: 2 printed.)

Comprises a member adapted to be mounted on the bolster spindle, a vertical rod journalled in a bearing on said member, a presser carried at the lower end of the rod to adapt it to swing outwardly from the axis of the spindle, a weight, a cord for suspending the weight on the member, and means to connect the cord to the rod to resist the turning movement of the latter by the action of gravity on the weight. —T. W.

Looms: Stop-motions; Shuttle. E. Burns, Salford. E.P.171,638, Nov. 24, 1921. (Appl. No. 2753/21.)

A leather strip is held in position on the tapering blade of the stop-rod finger of fast-reed looms by flanges. The leather is to take the blow from the swell. The malleable iron stop-rod finger is secured to the stop-rod by a set-screw. —T. W.

Artificial Silk Spinning Apparatus. James Clayton, Coventry, England, assignor to Courtaulds, Ltd. U.S.P.1,399,690, Dec. 6, 1921. Appl. 8/4/18. (10 claims: 1 printed.)

The apparatus comprises a rotary spinning box, a housing within which it rotates, and means for lifting the box to the upper part of the housing on completion of spinning operation to facilitate its discharge. —T. W.

Humidifying Spinning and Weaving Works. F.P.515,502. See Section 7.

3.—CONVERSION OF YARNS INTO FABRICS.

(C)—WEAVING.

Weaving Artificial Silk. Posselt's Text. Jl., 1921, **29**, 89.

This fibre is said to adapt itself more readily for weft than warp. The yarn should be wound on smooth, but not polished, paper tubes, 4½″ × ⅜″, indented as usual. The winding should be hard and free from knots; for expensive cloths pirns should be graded according to the number of knots. In the shuttle, the brush of worsted yarn in the eye is not good enough to stop curling, and the stiff fibre brush pressing against the spool damages the yarn. A slip of ¼″ elastic tape fixed diagonally to touch the spool is very good, and can be cheaply renewed. A better way is to place a strip of furniture velvet in the shuttle, extending from the eye to the bottom of the spool. In warping the work, including sizing, should be done directly on to the weavers' beams. Twisted yarns, though deficient in lustre, need no sizing. Sized yarns must be stored dry, and in weaving great care must be taken to avoid friction on the fibres from the harness. Weavers should be taught to tie a very small non-slipping knot, to avoid burling. Shedding should be timed to avoid some friction by beating-up the weft on a crossed shed.—F. G. P.

(D)—KNITTING.

Plated Knitted Patterns. W. Davis. Textile World, 1922, **61**, 317.

A method is described for making vertical striped patterns on knitted fabrics. Machines of the Cotton's patent class have their sinkers specially cut at the parts where a stripe is required, which have the effect of reversing the usual order of the two plaiting threads so as to cause them to change their places in the fabric and create a reversible colour effect. Difficulty is sometimes experienced in securing the proper angle of cut on the fancy sinkers, and special care has to be taken to have the tension of the yarn very tight so as to facilitate the turn-over of the thread. —W. D.

Gas Fastness of Dyeings. II. See Section 6.

(E)—LACEMAKING AND EMBROIDERING.

Belgian Lace Industry; Importance of the——. U.S. Commerce Reports, 1922, No.2, 80.

A serious source of competition for Belgian hand-made lace is imported machine-made lace from Germany, France and England. German competition in torchon and Cluny laces is specially serious. The prosperity of the hand-made industry depends greatly on the production of the finer laces that cannot be well imitated by the machine-made article, and it is precisely for these laces that the supply of labour is the least. Chantilly is practically no longer made in Belgium. The machine-made lace industry has extended somewhat in Belgium since the war. —L. M. S.

Embroidery Yarn. See Section 2D.

(G)—FABRICS.

Finishing Vigogne Fabrics. See Section 4K.

Half-Wool Crepons. See Section 4H.

Close-finished Cheviots. See Section 4D.

PATENTS.

Shuttle Actuating Mechanism for Looms. Richard Hattersley Smith, Keighley, England. U.S.P.1,396,602, Nov. 8, 1921. Appl. 27/8/17. Renewed 14/2/21. (2 claims: 2 printed.)

The loom has a rotary shaft, a picking cam mounted thereon, a picking shaft arranged at an angle to the vertical plane in which the rotary shaft of the loom is situated and also at an angle to the vertical plane in which the end frame of the loom is situated; an arm extending from the picking shaft at approximately right angles thereto, a picker, a strap secured to said arm and to said picker, supports and guides for said picker and a shuttle box within which picker operates. —T. W.

Looms: Dobbies; Pattern Surfaces. A. S. Wilmore, Derby. E.P.171,632, Nov. 24, 1921. (Appl. No. 36,295/20.)

The levers *l*, Fig. 1, in dobbies of the Keighley type, carry swinging balks connected to pairs of upper catch-levers *c* and pairs of lower catch-levers c^1, Figs. 1 and 2, whereby the levers *l* can be so operated to form a single or double shed. The catch-levers are controlled by feelers *f*, f^1 arranged in pairs, and are thereby moved out of the path of, or remain in position to be engaged by, corresponding pairs of upper and lower draw-knives *b*, b^1. The feelers *f* control the lower ones of the lower catch-levers c^1 by means of arms f^3, and the upper ones of the upper catch-levers *c* by means of spring-controlled wires g^1, whilst the feelers f^1 control the upper ones of the lower catch-levers c^1 by means of wires g^2, and the lower ones of the upper catch-levers *c* by means of wires *g*. The wires g^1, g^2 engage slots f^2 in the feelers *f*, f^1, and, when the feelers are operated by ordinary pegs on the lags, these slots prevent the wires g^1, g^2 and corresponding catches from being operated, so that only one of the catch-levers on a particular balk can engage and be drawn forwards by the draw-knives, and the lifting levers *e* are only given a single lift. Extra long pegs, inserted at intervals in the lags, move the feelers to such an extent that the wires g^1, g^2 are operated. The draw-knives are operated by lifting levers *l*, *m*. —T. W.

FIG. 1.

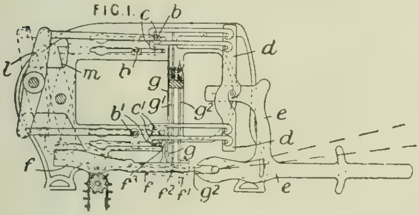
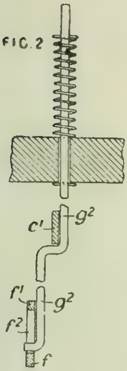


FIG. 2



Stop Motions for Textile Machines. A. Roberts, Bradford. E.P.172,357, Nov. 30, 1921. (Appl. No. 22,669/20.)

Relates to various types of electrical stop motions, with special reference to threads in spinning machines and the like, looms, knitting machines, etc. —T. W.

Weft Replenishing Mechanism for Looms. Henry W. Youngquist, Manchester, N.H., Assr. to Draper Cor. U.S.P. 1,396,154, Nov. 8, 1921. Appl. 21/8/19. (8 claims: 7 printed.)

A transferrer has a weft carrier controlling device having clamping jaws which engage opposite sides of the weft carrier between the head and the filler carrying portion. Rotation of the weft carrier during transfer is prevented. —T. W.

Feeler Mechanism for Looms. Alonzo E. Rhoades, Hopedale, Mass., Assr. to Draper Cor. U.S.P.1,396,665, Nov. 8, 1921. Appl. 15/10/20. (10 claims: 1 printed.)

The feeler is supported to enter the shuttle on a detecting beat in a direction inclined to the longitudinal axis of the shuttle, and which is held from movement along the weft carrier by engagement with the weft until substantial exhaustion thereof; also means for dealing with the mechanism in case of improperly boxed shuttle. —T. W.

Knitting Machine and Fabric (Spot Effect). Herbert T. Ballard, Norristown, Pa. U.S.P.1,397,069, Nov. 15, 1921. Appl. 15/1/20. (2 claims: 1 printed.)

In combination with a main yarn guide are:—A supplemental yarn guide, a feeding element for feeding the supplemental yarn to the main yarn guide, means for periodically moving the element and holding it between its periodic movements to act as a brake on the supplemental yarn, and driving means for the element comprising a toothed wheel meshing with the needle stems and having its teeth of such number as to divide unequally into the number of needles. —T. W.

Tension Device or Yarn Cleaner for Creels for Use in Warping or Beaming. Grindrod Kershaw, Whitworth, England. U.S.P.1,397,286, Nov. 15, 1921. Appl. 20/2/20. (12 claims: 1 printed.)

A support for tension discs, characterised by three horizontal parts, the uppermost to bear against a rail on which the support is to be mounted, the second having a guide notch, and the third adapted to bear tension discs; a plurality of tension discs horizontally mounted thereon, and an arm extending around part of the circumference of a tension disc on the support to present its upper edge a little below the horizontal surface presented by one tension disc to another. —T. W.

Shuttle Positioner. Ovide Legendre, Fitchburg, Mass., Assr. to Thomas C. Sheldon. U.S.P.1,398,699, Nov. 29, 1921. Appl. 15/11/19. (18 claims: 1 printed.)

A loom has, in combination with a shuttle, a shuttle box therefor, and means operable independently of the movement of the shuttle automatically to depress the shuttle to its operative position in the box. —T. W.

Lace Braiding Machine. Edwin Leroy Smith, Philadelphia, Pa., Assr. to Oscar Brauch, Philadelphia. U.S.P.1,397,299, Nov. 15, 1921. Appl. 20/3/20. (4 claims: 4 printed.)

The machine consists of a raceway plate, a bottom plate, posts carried by the bottom plate and projecting through the raceway plate, driver discs on said posts, an operating clutch member mounted on each of said posts, upwardly projecting pins carried by said clutch members for co-action with the driver discs, gear pins depending from the operating clutch members, an oscillating rack adapted to be engaged by said gear pins whereby a rotary motion may be transmitted to the driver discs, and means to actuate the operating clutch members to move the gear pins into engagement with the rack. —T. W.

Yarn Guide Mechanism for Knitting Machines. Elihu Lippitt, Lakewood, Ohio., Assr. of one-third to Huntington and one-third to Lippitt. U.S.P. 1,398,103, Nov. 22, 1921. Original Appl. 12/7/17. Divided and date of pres. Appl. 18/6/19. (6 claims: 1 printed.)

A knitting machine has, in combination, a needle bed, needles therein, a reciprocating cam carriage provided with cams for operating the needles, a yarn guide movable longitudinally in a path to guide the yarn to the needles, and means whereby the yarn guide is displaceable out of the path to a position where it will not be operated by the cam carriage; also means independent of the cam carriage for displacing the yarn guide, and a pattern chain controlling the operation. —T. W.

Stop Motion for Knitting Machines. Edson S. Hineline, Apponang, R.I., Assr. to Hineline Engineering Co. U.S.P.1,398,694, Nov. 29, 1921. Appl. 15/3/20. (24 claims: 1 printed.)

The combination with the needles of a knitting machine adapted for both rotary and reciprocating knitting, and a member mounted to slide towards and from the needles, and having functioning relation with respect to the normal path of the needles during rotary knitting whereby it may cause functioning of an emergency device, but having non-functioning relation with respect thereto during reciprocating knitting. —T. W.

Stop Mechanism for Looms. Henry W. Youngquist, Manchester, N.H., Assr. to Draper Cor. U.S.P.1,398,532, Nov. 29, 1921. Appl. 2/7/21. (10 claims: 1 printed.)

A loom comprises a whip roll, a warp stop motion operable upon detection of a warp fault to effect a stoppage of the loom and a releasably supported member operable when released by an abnormal movement of the whip roll, caused by a change in the tension of the warp, to initiate the action of the said stop motion. —T. W.

Braiding Machine. Xaver Pfrunder, Wohlen, Switzerland. U.S.P.1,398,444, Nov. 29, 1921. Appl. 3/6/21. (6 claims: 1 printed.)

Comprises a plurality of spool-carriers each having a recess, drivers provided with notches for the reception of the spool carriers, locking members each operatively connected at one end to a driver and at the other end adapted to engage in the recess of a carrier by performing a tilting motion on the end connected to the driver acting as a fulcrum, the locking member of one driver co-acting with the locking member of the adjacent driver irrespective of the direction of rotation, for performing the tilting movement during the transfer of a carrier from one driver to the adjacent driver, and means for preventing a turning motion of the carriers during transfer from one driver to another. —T. W.

Embroidering Mechanism. Joseph A. Groebli, New York, N.Y. U.S.P. 1,398,590, Nov. 29, 1921. Appl. 6/8/20. (9 claims: 1 printed.)

The mechanism comprises a plurality of embroidering machines, each embodying fabric carrying, shifting and tensioning means, common means for controlling the operation of the shifting and tensioning means to shift and tension the fabric on the carrying means of each and optionally of a plurality of the several embroidering machines. —T. W.

Attachment for Knitting Machines. Wilbur C. Potter and Edward H. Stines, New Brunswick, N.J. U.S.P.1,398,570, Nov. 29, 1921. Appl. 29/6/18. (6 claims: 1 printed.)

The apparatus has, in combination, a casing for the stop mechanism of a knitting machine, a plurality of arms mounted on the casing, a rock shaft on each arm projecting to the inside of said casing; arms on the rock shafts inside the casing projecting alternately in opposite directions, and tension devices for said shafts to hold them yieldingly in the required position. —T. W.

Terry or Looped Fabric. Percival Taylor, Bolton, England, Assr. of one-half to J. J. Hodgkinson and Pearson, Ltd., Manchester. U.S.P.1,398,752, Nov. 29, 1921. Appl. 31/3/19. (3 claims: 1 printed.)

A terry fabric is composed of terry warp threads arranged in pairs, one thread of each pair being made to take over two threads of weft over which it forms a loop, the other thread of said pair taking over three threads of weft, also to form a loop, while the two threads of the pair of terry warp threads adjoining the former pair are arranged so that one of this secondary pair of threads takes under two threads of weft to form a loop and the other of said second pair of threads takes under three threads of weft, also to form a loop, thus forming terry loops of two sizes on both sides of the fabric. —T. W.

Knitting Machines. K. Howie and W. O Taylor, c/o Wildman Mfg. Co., of Norristown and Limerick, both in Pensylvania, U.S.A. E.P.171,987. (Appl. No. 29,372/21.) Conv. Nov. 26, 1920.

Relates to striping mechanism in which the yarn changes are initiated by electromagnetic means while the power employed in effecting the changes is transmitted mechanically, preferably through a rotating part of the machine. The invention is particularly applicable to spring-needle, multi-feed machines in which the cam-ring is fixed while the needle-carrier rotates. The magnets are energised in any desired order for making the pattern by a jacquard. —T. W.

Feeler Mechanism for Looms. Isaac Snow, Lawrence, Mass., Assr. to Draper Cor. U.S.P.1,396,669 (11 claims: 1 printed) and 1,396,670 (13 claims: 1 printed); 1,396,671, Appl. 22/7/20 (13 claims: 1 printed); 1,396,672, Appl. 27/11/20 (12 claims: 1 printed), all of Nov. 8, 1921.

All relate to feeler mechanism for looms of Northrop type. —T. W.

Looms: Smallware Looms, etc. C. Chorlier, St. Etienne, Loire, France, E.P.171,673. (Appl. No. 25,297/21.) Conv. Nov. 19, 1920.

In ribbon weaving looms the plain healds, shuttle-driving devices, and the regulator comprising fabric-winding drums are all actuated by an 8-shaped groove, or by two such grooves, in the face of a cylinder on the main shaft. The latter drives the lay by means of a crank-disc and a connecting rod. A lever, actuated by the 8-shaped groove, is connected by adjustable levers to the healds, while a second lever, also actuated by the groove, carries a finger which is connected by a slide or a connecting rod to the driving rod of the shuttles. The latter lever also actuates the fabric winding drums by means of an adjustable rod, ratchet mechanism, and worm gearing, and the lever is adjustable on its pivot to vary the stroke of the shuttles. A modification for four healds is mentioned, while additional healds, operated by supplementary cams on a shaft, are used in weaving fabrics with more complicated designs than are possible on four healds. —T. W.

Embroidery Machine. James Edward Hodgson, New York. U.S.P.1,395,961, Nov. 1, 1921. Appl. 4/12/20. (2 claims: 1 printed.)

The device has, in combination, a tubular needle having an angularly bent lower portion, a length of wire bent to form a foot and an off-set portion and a pair of legs lying parallel with said needle, a guide member securing the legs of said wire together and forming a guideway for said needle, and a guide member secured to said needle between the first guide member and said foot and embracing said legs. —T. W.

Art of Rug Weaving and the Product resulting therefrom. David H. Stroud, Jnr., Philadelphia. U.S.P.1,394,869, Oct. 25, 1921. Appl. 25/1/19. (7 claims: 1 printed.)

A rug has a woven body portion comprising interwoven series of wefts and binder warps with stuffer warps inlaid therein co-extensively with said binder warps and a woven edging comprising wefts interwoven with one class of the aforesaid warps to the exclusion of the rest.—T. W.

Weaving; Looms. Naamlooze Vennootschap Stoomweveriz Voorheen Vissers and Eycken, and A. W. Jansen, Geldrop, Holland. E.P.171,704. Appl. No. 31,031/21.) Conv. Nov. 20, 1920.

In weaving "bicycle and auto-canvas," diagonal canvas, etc., the warp threads pass direct from bobbins in a bank or creel through eyes, then through a reed mounted resiliently on a brace, to a feeding or brake device comprising a roller covered with felt or other friction material and having front and back tension rollers, whence the warp threads pass over a smoothing beam to the healds of the loom. The "cross" bobbins in the creel are carried by pins on V-shaped carriers secured to vertical frames. —T. W.

Looms: Checking Picking Sticks. R. Haddon, London. (J. M. Hunt, Atlanta, Georgia, U.S.A.) E.P.172,197, Dec. 8, 1921. (Appl. No. 30,851/20.)

A concave-faced bar with other framework is movably guided in a channel in a block fixed on the lay and is held by a bolt passing through a slot in the bar to allow limited oscillation. When the picker stick in its oscillation motion carries the bar along with it, the concave surface of the bar bears against a friction washer on a bolt, the washer being yieldingly held against the surface by an adjustable spring so that the pressure and resistance increase as the bar is carried farther from its central position. The head of the bolt is arc-shaped and so is the washer-retaining cap to afford a rocking connection between the cap and bolt to prevent the bar from binding. Buffer blocks are provided. —T. W.

Winding Yarns, etc. A. Smith, Crosshills, near Keighley. E.P.172,407, Dec. 5, 1921. (Appl. No. 25,520/20.)

In machines for winding upon spools, bobbins, tubes, or the like, of the kind wherein the spindle is reciprocated and the thread-guide is advanced to build the cop, the thread-guide is mounted on a bracket provided with a spring-catch engaging a screw which is rotated by a ratchet wheel and pawl actuated by a cam. The cam is mounted on a shaft driven from the spindle or on a supplementary shaft driven through change gearing from the cam shaft. Two retaining catches, one mounted slightly in advance of the other, prevent backward movement of the screw. Spec. 13863/88 is referred to. —T. W.

Stop Motion of the Weft in Looms. R. Dantzer. F.P.512,804. Appl. 16/3/20.

An apparatus catching or taking out the weft at each pick on looms is referred to, and is characterised by:—The use of a straight and sharp needle disposed above and on each side of the warp against the last yarns of the selvage; the sense of motion of this needle receiving alternately first a lifting, afterwards a backing, then a forwarding, and finally a sinking motion concomitently with the motions of the slay. —Bur. Text.

Looms: Fabrics. H. Arquint, Richterswiel, Switzerland. E.P.172,315. (Appl. No. 32,337/21.) Conv. Dec. 2, 1920.

Relates to looms for weaving fabrics such as mats, sack cloth, etc., the warp and weft threads consisting of ropes of wood, wool, hay, straw, grass, wires, etc. In some cases the weft may also be made of wooden rods, reed, etc. The warps may comprise two ropes alternately twisted to the right and to the left to serve as distance pieces for the weft; intermediate untwisted rope warps may be employed. The twisting of the warps is effected by passing them in pairs through rotating tubular spindles or guides, and the warp may be drawn from bobbins arranged in a room above the loom, the take-up device for the fabric being mounted in a room below. The shed is formed by means of beams or levers oscillating on axles, while the weft is inserted by a packet which is adapted to roll down an inclined guide. An alternative method is described. —T. W.

Temple Thread Parter for Looms. Ulysse N. Trembley, South Lawrence, Mass., Assr. to Draper Corporation. U.S.P. 1,394,652, Oct. 25, 1921. Appl. 14/2/21. (7 claims: 1 printed.)

The device comprises a loom temple with thread parter, a detent operable to lock the thread parter in inoperative position, means tending normally to withhold the detent from locking position, means operative upon a pre-determined number of movements of the thread parter to force and to hold the detent in locking position and means for releasing the detent.—T. W.

Warp Stop Motion for Looms. Arthur S. Cowan, Boston, Mass., Assr. by mesne assignments to The Stafford Co. U.S.P. 1,394,970, Oct. 25, 1921. Appl. 16/7/21. (9 claims: 1 printed.)

The motion comprises one or more reciprocating feeler rods, the back stop-bars, and transversely extending elements above said bars, of an intermediate bridge or brace comprising an upper section engaging and supported by the latter elements, and a lower section supported by said upper section, having recessed seats receiving the back stop-bars, and having adjacent such seat surfaces which conjointly with the tops of the back stop-bars constitute a race or guideway for the feeler rod or rods. —T. W.

Looms: Shuttles. R. E. Steward, Malabar Hill, Bombay. E.P.172,152, Dec. 8, 1921. (Appl. No. 26,379/20.)

A loom shuttle has a core at each end, the walls or filling pieces being glued or cemented to the core. Each core has a tip and a ferrule, consisting of wires soldered together to form a band. The peg is kept in place by a flexible plate. —T. W.

Spools. Cohen and Schaefer Weberie-Apparaten-Fabrik, Lachen, Switzerland (Assees. of A. Schaefer). E.P.172,278. (Appl. No. 19,195/21.) Conv. Nov. 27, 1920.

A bobbin or pirn for automatic weaving has the shank part made of a light, strong metal, steel rings being provided for the butt end. —T. W.

Filling-end Catcher for Looms. Charles E. Nutting, Hopedale, Mass., Assr. to Draper Corporation. U.S.P.1,394,637, Oct. 25, 1921. Appl. 2/10/18. (3 claims: 1 printed.)

Relates to means for preventing a smash if an obstruction is caught between the weft end catcher and the lay. —T. W.

Transferring Mechanism for Automatic Weft-replenishing Looms. Alonzo E. Rhoades, Hopedale, Mass., Assr. to Draper Corporation. U.S.P.1,395,010, Oct. 25, 1921. Appl. 5/8/20. (8 claims: 1 printed.)

Battery Mechanism for Automatic Weft-replenishing Looms. U.S.P.1,395,011. (3 claims: 1 printed.)

Filling Severing Means for Automatic Weft-replenishing Looms. U.S.P. 1,395,012. (13 claims: 1 printed.)

All three refer to the various parts of automatic looms of the Northrop type.—T. W.

Method of Heddling and Warping. William F. Grupe, North Bergen, N.J., Assr. to Endless Belt Corporation. U.S.P.1,395,818, Nov. 1, 1921. Appl. 15/2/18. (7 claims: 1 printed.)

The method of heddling and warping consists of positioning a warp thread and forming an initial portion of a heddle, and thereafter adding the remaining portion or portions of the heddle while enclosing the positioned warp thread in the eye of the resulting heddle. —T. W.

Reed Weaving Machine. Marshall B. Lloyd, Menominee, Mich., Assr. by mesne assignments to Heywood-Wakefield Co. U.S.P.1,395,964, Nov. 1, 1921. Appl. 9/10/18. (19 claims: 1 printed.)

The apparatus for weaving reed fabric embodies therein templet members swingably mounted for movement to an outer operative position and to an inner inoperative position, means formed to receive and hold stakes in weaving relation thereto, and means for effecting the placement of a weft strand upon the outer side of some stakes and upon the inner side of others whereby a fabric can be formed as a separate unit apart from the fabric templet members. —T. W.

Knitted Cap. David Karger, Milwaukee, Wis. U.S.P.1,395,230, Oct. 25, 1921. Appl. 7/3/21. (3 claims: 1 printed.)
A knitted cap has a crown, and a band secured to the rear and side portions of the crown and adapted to be swung upwardly or downwardly from the lower margin of the crown, the ends of the band being rack knitted to form transverse extensions to provide ear muffs, and means carried by said crown for temporarily holding said ear muffs in a raised position when said band is adjusted to an upwardly extending position. —T. W.

Picker for Loom. E. Rapiot. F.P.516,320. Appl. 3/6/20.
A metallic picker designed to substitute buffalo-skin pickers is described. —Bur. Text.

Humidifying Spinning and Weaving Works. F.P.515,502. See Section 7.

4.—CHEMICAL AND OTHER PROCESSES.

(A)—Boiling.

Dyeing and Finishing Wool and Silk Fabrics for Umbrellas (Glorias). See Section 4I.

(B)—Scouring and Degumming.

Dyeing and Finishing Wool and Silk Fabrics for Umbrellas (Glorias). See Section 4I.

(D)—Milling.

Close-finished Cheviots. Posselt's Text. Jl., 1921, **29**, No.4, XVII.
These goods are run about 3 hrs. in the mill; and 4 ozs. of hard soap with 2½ ozs. of alkali ought to be sufficient, but if the lather shows slowness in starting when it reaches the washer another ounce of soap should be added. If the lather does not appear to be well maintained, soap should be added in quarter ounces at fairly frequent intervals. All oil used in the yarn manufacture must be thoroughly removed before the goods leave the washer. When the goods are milled, they are subjected to a second scouring, which is accomplished without the aid of more soap, as that remaining after milling is sufficient for the purpose. The scouring temperature should be from 100 to 110°F. After extracting and dyeing, brushing with a little steam and shearing should follow. —W. D.

(E)—Drying and Conditioning.

Conditioning of Textile Raw Materials and Yarns. E. Möller. Spinner und Weber, 1921, **39**, Nos. 48-52.
In this monograph the following points are dealt with:—Calculation of humidity, relative humidity necessary for spinning of different fibres and the normal condition, in detail, for various yarns; methods of sampling and calculation of "condition" weight; the question of the abstraction of water from the yarn by the case and packing, and the problem of gross and nett weight; the method of determination of moisture content, and the exact conditions to be observed in general and in special cases; and conclusion with specimen form for reporting on "condition." —E. B. A.

(G)—Bleaching.

Bleaching Outing Flannel. Posselt's Text. Jl., 1921, **29**, XXIII.
Bisulphite of soda 76°Tw. should be used in the proportion of 8 galls. per 1,000 galls. water; 5lbs. of oil of vitriol should be added to this. The material is run in the liquor for 30-45 min., and should then be washed thoroughly, using 2lbs. soda per 15 galls. water, and rinsed. An alternative method is to bleach in a sulphur stove; the cloth must be scoured very clean previous to bleaching. —H. R. H.

Bleaching Silk. Posselt's Text. Jl., 1921, **29**, 102.
The following formula is given:—1·4lb. of sodium carbonate (dry), 60 hydrogen peroxide 10 vol., 3·8 quarts sodium silicate 40 deg. to 100 gall. water. The alkalinity of the bath should be 1·3 parts per 1,000. After heating to 160°F. and removing scum, the bath is ready for the goods, which are moved for 10 min. and pressed down, being left in overnight. The goods are removed, rinsed warm and soured. The bath is replenished daily with additions of hydrogen peroxide and silicate as required, and needs renewal when it becomes dirty from the goods or tends to deposit gelatinous silica. —F. G. P.

Bleaching Method for Blue Cotton. Indian Text. Jl., 1921, **32**, 81.
It is stated that a method has been invented for the bleaching of blue bender, blue Texas, or blue stain cotton white. —L. M. S.

Bleaching Silk. Posselt's Text. Jl., 1921, **29**, 127.
The wording of the paragraph makes it appear that dyeing and bleaching are performed together, giving better results than when done separately. It may mean that delay of sending bleached silk to a dyeworks tends to deteriorate the goods. —F. G. P.

Cotton; Preliminary Manufacturing Tests of the Official Cotton Standards of the United States for Colour for Upland Tinged and Stained——. See Section 6.

(H)—Mercerising.

Half-Wool Crepons. Posselt's Text. Jl., 1921, **29**, 78.
These fabrics, which have been largely used to substitute the all-wool crepon, consist of a cotton warp with a woollen weft mixed with cotton. The first process is scouring with soda whilst wound flat on the beams, but in the case of hard

materials such as mohair crabbing in boiling water with soda or ammonia should be carried out to render the wool smoother and more lustrous. Mercerising follows, and should be very carefully done to prevent the wool being tendered in contact with the alkalies. The strength of the caustic lye should be between 15 and 30°Bé.; it should be kept cold, and its action limited to a very short time, varying from 1 to 3 mins. On leaving the mercerising bath the goods immediately pass between rollers into the souring bath which is used cold and contains 3% sulphuric or 5% hydrochloric acid. The baths are best kept cool by cooled brine circulating in iron pipes immersed in the lye. —W. D

(I)—Dyeing.

Production of Sound Wool. Spinner und Weber, 1922, No.3, 5.

Strong acids hydrolise the basic groups of wool, giving not only a loss of wool substance but diminishing the resistance of the wool to alkalies in scouring, milling, etc. The author states that sulphuric acid and glauber salt dye baths have a harmful influence, and he recommends replacing them with acetic acid and sodium acetate. Sodium acetate reduces the action of alkalies in the hydrosulphite vat.
—H. R. H.

Dyeing and Finishing Wool and Silk Fabrics for Umbrellas (Glorias). H. Nettelhorst. Textilberichte, 1921, **2**, 358, 433, 445.

Silk yarn is degummed before weaving. The most important process is the crabbing, which consists of passage without pressure through a soap bath and two baths of boiling water. The crabbing should be done on perforated copper cylinders for 2-3 min. at atmospheric pressure. When cool the material should be singed on plate singeing machines, twice on the right side and once on the wrong side, cooled, rolled, and crabbed in two baths of boiling water. For degumming in the piece, boil in a solution of soda, tallow curd soap and monopole soap for 1½ hrs., rinse in hot water at 60°C. containing ammonia, and crab as above. A special machine is used for degumming. The dyes used must be absolutely weatherproof; logwood black and alizarine colours on chrome mordant should be used. The fabric should be finished in a hydraulic press, and where a specially silky handle is required should be treated with gum arabic. It is not necessary to waterproof good quality glorias. —H. R. H.

Azophor Red on Cotton Goods. W. B. Nanson. Text. Amer., 1922, **37**, 16-17.

Practical details are given for dyeing for dull and bright shades with "Azophore Red"—a combination of diazotised paranitraniline with aluminium sulphate, which is very much more convenient to use as a starting point than paranitraniline.
—F. C. W.

Silk Dyeing: Novelties in Souple Weighting. Posselt's Text. Jl., 1921, **29**, 125.

Very heavy weighting is rarely done. Weighting by tannin is performed by boiling raw silk for several hours in tan; it may be dyed before or after. Tanning after dyeing renders many dyes very fast, but tends to alter the shade. Silk is washed in lukewarm soda, then put in colourless tan at 40°C., and raised slowly to 70°, and allowed to stand for 2—3 hrs. It is then boiled in 3% sulphurous acid, stood for an hour, and again boiled, then washed in warm water. After draining overnight the silk is again tanned for several hours and again treated with sulphurous acid. These processes are repeated until the desired weighting is attained. The goods are dyed and again tanned. Another method is to precipitate the tan with prepared gelatine. This solution is made by heating for 1hr. at 60°C., 10 kg. gelatine with 1·26 kg. nitric acid (sp. gr. 1·332), then adding 1·10 kg. soda and diluting with 20 l. of water. A tan bath of 15—20% just acid with sulphuric is heated to 60°C., the silk entered, and raised to 90°; at this stage 10% on silk of the gelatine solution is added and the goods worked for 2 hrs.; 10% weighting can be produced in this way, which may be repeated as required. Dyeing for dark shades may be done early, but for light colours it is done at the end of the process. —F. G. P.

Cross-Dyeing Artificial Silk and Cotton. Posselt's Text. Jl., 1921, **29**, No.6, XI.

Various suggestions are made which do not appear to have been tried in practice. The artificial fibre may be mordanted with 3% solution of tannin and 2% stannous chloride. After weaving the fabric is dyed with a direct colour, when the cotton will give the normal shade and the mordanted fibre another. An alternative method would be to nitrate one of the fibres with sulphuric-nitric acid mixture, which renders it non-absorbent of direct colours. The author doubts if the process is of any value to the dyer. Converting one of the fibres into cellulose acetate is also suggested, as this material is said to be unstained by direct colours. Both the nitrate and acetate will dye with basic colours. —F. G. P.

Silk in its Relation to Dyestuffs. E. Cagliostro. Color Trade Jl., 1922, **10**, 1-5.

Silk fibre is considered to be a continuous rod of hardened insoluble gelatinous matter which swells slightly and softens in water. There are apparently no internal channels that might give rise to capillarity. The author appears to reject the idea of a chemical action between the dye and the silk in favour of a physical absorption. The water in which the dye is dissolved acts as a carrier of colour molecules among the silk molecules, and a system of solid permanent combination arises. The author holds that the action cannot be chemical because the colour can in some cases be dissolved away from silk by alcohol. At the same time, he agrees to a certain affinity between the silk and dye which does not exist between silk and sodium chloride. Dyes which have no affinity are said to be insoluble in water, forming merely an emulsion; by mordanting with certain substances, such dyes form colour lakes with the metallic salts in the silk which are generally good fast colours. Logwood on iron-tannin mordant is the principal of these. The effects of time and heat are discussed; in connection with diazotising the author speaks of the formation of a golden yellow dyestuff by combination of the diazo body in paranitroaniline with the amino body in silk. —F. G. P.

Fastness of Basic Dyes to Light. G. Emmons. Silk (N.Y.), 1922, **15**, 67.
Six basic dyes are named as being fast to light on silk and two which are so on tin-weighted silk. The method of dyeing with Rhodamine B (and Rosazeine B and Safraniline) is given:—Using a broken boil-off liquor bath, work the goods at 40°C. before putting in the dye solution; work the goods after re-entering and raise to 60°C. and to boil. If an acid bath without boiled-off liquor is used, the goods are entered at 60°C. and raised to 80°C. Ethyl and Malachite Greens are dyed in a faintly alkaline bath and after-treated with acid. Resorcin-, Fluorescent-, and Iris-blues give a fluorescent effect on silk in gas-light, but are not suitable for other fibres. They are stated to be fast to light. Basic dyes generally have a good affinity for tin-weighted silk. If the silk is stored for a considerable time before dyeing, patchy places may show up. There is a brief description of the weighting process. Tin weighting is said to be followed in some cases by a tannin bath instead of sodium phosphate. Slightly acid warm water should be used for dissolving basic dyes—not boiling water, which decomposes them. Methylated spirit or acetin may be used as an assistant. Auramine decomposes at 77°C. Bismarck Brown is said to be fugitive. —F. G. P.

Cotton; Preliminary Manufacturing Tests of the Official Cotton Standards of the United States for Colour for Upland Tinged and Stained——. See Section 6.

Azo Dyes; Electrometric Titration of——. See Section 6.

Gas Fastness of Dyeings. II. See Section 6.

Chemical Action of Sunlight on Dyed Fabrics. See Section 6.

Dyeing and Printing of Foulards. See Section 4J.

The Status of a Dyer. See This *Jl.* (Proc.), 1922, **13**, 33.

Faults in Dyeing Woollen and Worsted Pieces. See This *Jl.* (Proc.), 1922, **13**, 31.

(J)—PRINTING.

Dyeing and Printing of Foulards. Posselt's Text. Jl., 1921, **29**, 97.
Foulards are made by direct printing or by dyeing and discharging, and sometimes by resist effects. Before printing the grey cloth should be thoroughly cleaned, singed and boiled-off. Spider wheels are recommended for fine texture silks in the latter operation. Thorough rinsing is essential; bleaching is sometimes necessary. Diamine or direct colours are used for printing as being completely fixed in steaming and not staining the whites in washing. The following formula is given as being a good one:—Colour, ½—3 parts; water, 45½—39; phosphate of soda, 1—3; glycerine, 3—5; gum solution, 50 parts; gum solution being made up of equal parts of water and senegal, dextrine, and British gum, mixed or alone. A list of suitable dyes is given. After printing and moderate drying the silk is steamed at 3—3½lb. in the cottage steamer, and then washed cold, scrooped, whizzed and dried. The production of discharge effects is described and several formulæ are given. It is stated that basic dyes are chiefly used in discharge work for foulards. —F. G. P.

Cotton Printing; Investigations on the Quantitative Relations in the Fixing of Alizarine Red in——. R. Haller and F. Kurzweil. Textilberichte, 1922, **3**, 21.
In the finishing of Alizarine Red prints, considerable quantities of the lake are removed in the steaming, washing, and soaping. The authors found that on washing a print in the normal way, but omitting soaping, so as not to introduce complications, the following losses occurred:—Al_2O_3, 33%; CaO, 7%; Alizarine, 10%; and oil, 14%. Modifying a printing according to the above losses, they found that the loss was much less than normal when excess of mordant and alizarine are used. But even with an exact composition a certain proportion of the pigment remains insufficiently combined with the fibre, and therefore is lost in washing. Consequently, it is always necessary to use, for a certain result, a concentration in excess of that apparently required. —E. B. A.

(K)—FINISHING.

Shrinking Woollen and Worsted Fabrics. Posselt's Text. Jl., 1921, **29**, XVI.
The fabrics should be steamed and brushed, then passed over the damping and dewing machine for thoroughly and evenly moistening the cloth. Evenness is essential. This treatment should be followed by a second steaming, using a steam box attached to the dewing machine, and then drying without tension on warp or weft. To accomplish this, the piece is hung over rods and hot air is introduced through a perforated floor. Drying must not be complete, but just sufficient to give the necessary handle. —H. R. H.

Silk Finishing. Posselt's Text. Jl., 1921, **29**, 96.

Cheaper goods and half silks as woven are cleaned of knots, loose ends, and grease, and then rubbed with thin scratchers of spring steel or horn, by hand or machinery, in order to distribute warp and weft uniformly. The fabric needs to be tightly stretched between rollers on a frame for this purpose. —F. G. P.

Lustre Finish on Woollens. Posselt's Text. Jl., 1921, **29**, VII.

"Face" finish goods require special care in every process; carefully selected raw material is important. Pieces must be set wide in the loom to allow of sufficient shrinkage in milling to give a close dense cloth; milling must be slow and kept as cool as possible to avoid sponginess. Raising must be done fairly wet; a dense even nap must be obtained and finished off wet with old teazles. The lustre is obtained on the steam gig, the cloth being wound on to perforated rollers and passed from one roller to the other through a trough of water while steam is blown through the cloth. The cylinder of the gig is clothed with wood fibre brushes. Alternate steaming and cooling under strong tension gives the necessary lustre. —H. R. H.

Silk Weighting. Posselt's Text. Jl., 1921, **29**, 132.

Discusses tin weighting at length from historical and practical standpoints. Lead, bismuth, nickel, copper, manganese and antimony cannot replace tin, but aluminium has been found to be of some use. Great stress is laid upon the economic necessity of collecting the tin from wash waters. For black dyeing tannin and iron are mostly used.—F. G. P.

Production of Crimped Crape in Cotton and Artificial Silk. Industrie Text., 1922, **37**, 32.

The process developed by an English firm is described. The material is treated with a solution of normal or basic acetate of aluminium and dried, after a preliminary treatment with albumen or gelatine hardened with formaldehyde. The goods are dyed black or any other colour and then softened with oil or soap before crimping. After crimping the crape is dressed and finished; in the case of silk crape this is applied by passing through the nip of a mangle, but this is not applicable to cotton and artificial silk because the figure would be flattened or damaged. The solution is therefore sprayed on with compressed air. The solution mentioned is shellac in methyl alcohol. Diaminogen black is recommended for development with beta-naphthol and phenylene diamine or a direct colour such as diamine black. Shellac solution of 450 grm. in 4·5 litres is mentioned; extra stiffness may be acquired by repeated dressing. For matt effects the back of the material only is dressed. The dressed crape is finally heated to fix the shellac. —F. G. P.

Weighting Silk; A New Method of——. Spinner und Weber, 1922, No.5, 5.

The use of salts of zirconium or other rare earths instead of tin salts is urged. Pure cerium salts cannot be used because their hydroxides easily oxidise and affect the fibre. Only such salts can be used whose hydroxides do not oxidise in the air. These salts have no bad effect on the fibre and are easily fixed, and as they are obtained as bye-products of the gas mantle industry they are low in cost. Titanium salts, excepting the chloride, can be used in admixture, *e.g.*, 80% titanium and 20% tin (as oxides); the pure titanium salts colour the fibre yellow, but not the mixture. The admixture also gives a higher weight. A mixture of 55% titanium, 35% tin and 10% zirconium (as oxides) leaves the fibre absolutely white. Cerium can be used in conjunction with titanium, but the fibre is coloured to some extent by the cerium. —E. B. A.

Finishing Vigogne Fabrics. Posselt's Text. Jl., 1921, **29**, X.

Fabrics made from cotton waste and reworked cotton materials are known by the term "vigogne." The extra and repeated working of the cotton makes the fibre very short in staple, with the result that the cloth itself is rather poor in quality. As it leaves the loom the material is generally dark grey in colour. After sorting, the pieces are marked, raised or singed, and then dyed. When dyeing on the jigger, the roller should only be very lightly braked. Substantive dyes are generally used, improved brightness being secured by topping with the basic dyes. Printed effects are obtained by discharging with hydrosulphite. According to the depth of the engraving on the printing roller, an amount of formaldehyde-sulphoxylate varying from 80 to 200 grams is used per litre of printing paste, along with 150 to 300 grams of zinc white (for white effects), fixed by glue or albumen. Coloured discharge effects are not as a rule successfully produced on these materials by the use of the basic dyestuffs; it is generally preferred to apply suitably coloured pigments. —L. M. S.

Motors for Textile Finishing Plants. See Section 7C.

Adjustable Speed Motors and Control in Finishing Plants. See Section 7C.

Dyeing and Finishing Wool and Silk Fabrics for Umbrellas (Glorias). See Section 4I

PATENTS.

Method of Bleaching and Apparatus Therefor. Charles Taylor, Kearsley, Manchester, England. U.S.P.1,396,792, Nov. 15, 1921. Appl. 20/9/20. (3 claims: 1 printed.)

Relates to bleaching apparatus for cloth in rope form. The cloth is automatically piled in the kiers, and the cloths then passed simultaneously through a mangle. Automatic means are used throughout. —T. W.

Method of Treating Cotton Fibres and Products. William C. Johnson, Memphia, Tenn. U.S.P.1,396,960, Nov. 15, 1921. Appl. 15/12/19. (4 claims: 1 printed.)

Relates to forming absorbent cotton fibres into solid bodies, by first beating and brushing out the fibres, then mixing the fibres with water and flowing into a compressing mold, and then pressing the mass while wet into a condensed block; and, lastly, substantially drying out the water. —T. W.

Machine for Making Flexible Waterproof Roofing. Solomon H. Goldberg Chicago, Assr. to Charles S. Bird, Mass. U.S.P.1,392,323, Oct. 4, 1921. Appl. 23/5/14. (1 claim: 1 printed.)

The machine comprises means for unwinding and feeding a roll of flexible material (backing) through a saturating tank, pressure rolls through which the saturated backing sheet passes, means for applying granular facing to the adhesive face of the sheet, and means for applying a printed design on the granular facing, comprising a printer roll, a pressure roll co-operating therewith, a plurality of rolls for feeding regulated quantities of liquid to the printer roll and a liquid supply tank in which the feeding rolls ride. —T. W.

Process of Dyeing and Apparatus Therefor. B. F. Touchstone, T. E. Gardner, J. A. Bangle, D. M. Sullivan, and John E. Hardin, Greensboro, N.C. U.S.P. 1,399,230, Dec. 6, 1921. Appl. 8/9/20. (16 claims: 1 printed.)

The method of treating warps consists in reducing a complete set of yarn ends or threads to sheet form, conducting the sheet continuously through common yarn dyeing and treating means, and then in continuous pursuance to said treatment, winding the same directly upon a loom beam. —T. W.

Cloth Clamp. Joseph Evert Berry, Carthage, Mo. U.S.P.1,392,552, Oct. 4, 1921. Appl. 13/7/20. (5 claims: 1 printed.)

The device consists of a cutting table, a clamping member tiltably and slidably connected thereto, and including a clamping bar and a cross bar, a lever overhanging the cross bar, means for actuating said lever, and a spacing block pivotally connected to the lever and movable to position between the lever and the cross bar. —T. W.

Fabric Guiding Devices. J. A. Kent, Manchester, and J. H. Tomlinson, Oldham. E.P.170,529, Oct. 27, 1921. (Appl. No. 2,508/21.)

Electrical signalling devices are provided on both sides of a machine to operate when the cloth moves from a central path. In the device shown, the cloth, which normally passes between an adjustably-mounted ball and a table, breaks the electric contact between them; if the cloth moves sideways out of the central path, the ball comes in contact with the table, closes the circuit, and operates a signal such as a bell or a lamp. —T. W.

Singeing Fabrics. W. Osthoff, Barmen, Germany. E.P.171,131, Oct. 31, 1921. (Appl. No. 17,868/20.)

The burners of a fabric-singeing machine are supplied at or near the middle with the combustible gas and air mixture, and at the ends with compressed air, the relative quantities of combustible mixture and air being regulable so as to vary the width of the flames to correspond to the width of the fabric. The gas and air are supplied at the same pressure from compressors to a mixing and distributing apparatus from which the combustible mixture passes through a main conduit to branch conduits and thence to the burners, while the compressed air passes through somewhat similar main and branch conduits to side channels and communicates with the burners through apertures. The burners may be partitioned in the middle in singeing machines where two fabrics pass through side by side. Means are provided to adjust the composition of the combustible mixture, while the intensity of the flames is adjusted by controlling the supply of compressed air to the ends of the burners by the partial rotation of a piston. —T. W.

Thread Holder and Tensioner. Edgar C. Matson, Handley, W. Va., Assr. of one-half to J. A. B. Holt, Pratt. U.S.P. 1,398,877, Nov. 29, 1921. Appl. 19/1/20. Renewed Apl. 26, 1921. (6 claims: 1 printed.)

The tensioning appliance comprises a plurality of threads, a shaft, a plurality of pairs of thread-clamping jaws mounted on said shaft and adjustable relative to one another along the shaft, means including a spring to press the pair of jaws towards one another, and thereby press the jaws of each pair towards one another, and a universal adjusting member operable simultaneously to change the tension of these pairs of jaws from one uniform tension to a different uniform tension. —T. W.

6.—ANALYSIS, TESTING, GRADING, AND DEFECTS.

Hygrometric and Regain Tables; Some New Forms of——and Comments Thereon. W. D. Hartshorne. Bull. Nat. Assocn. Wool Mfrs., 1921, **51**, 369-388.

In presenting this series of tables for clean wool regains, cotton regains, relative humidity, absolute humidity and dewpoint temperatures the author hopes that some of the practical difficulties in reading the facts deducible from his unit system charts may be overcome, and he also extends the data made thus available to temperatures beyond the limits of verified observations, for the tentative "regain" figures given for high temperature conditions. An appendix gives the formulæ for obtaining relative humidity and a summary of the laws of regain, taken from the author's revision of 1917 (See *Trans. Amer. Soc. Mech. Engineers*, Vol. 39, p.1073). —L. M. S.

Some Experiments on the Production of Power Alcohol and Paper Pulp from Megasse. G. J. Fowler and B. Bannerjee. Jl. Indian Inst. Science, 1921, **4**, 241-260.

Experiments were undertaken with the object of obtaining power alcohol from the sugar and saccharifiable matter of megasse (the residual substance of sugar-cane left after expression of the juice) and fibre suitable for paper from the residue. Megasse is chiefly used as a fuel, and about 4 to 5 tons of megasse are equal to 1 ton of ordinary coal. The net yield of alcohol was found to be from 8—9%, which compares favourably with the best results so far obtained from wood-waste. —L. M. S.

Wool; Judging the Fineness of——. J. A. Hill. Wool Rec., 1921, **20**, 1662.

A method of measuring the diameters of wool fibres practised at the University of Wyoming is described. A micrometer caliper graduated to ten-thousandths of an inch is used. It is claimed that the method is much quicker, though less accurate, than a microscope with micrometer attachment, and also that a better discrimination of fineness is possible. With the microscope an enlarged image is obtained which may be impressed on the mind more than the true size of the fibres, to the detriment of a proper judgment of the wool quality.
—F. P.

Preservation of Canvas Sacks Intended for the Reception of Products used in Agriculture. G. Lavergne. Bull. Agric. Intell. (from Comptes rendus de l'Académie d'Agric. de France, 1921, **8**, 29-30), 1921, **12**, 497.

Sacks of canvas were found to be rapidly destroyed by the corrosive action of damp alkaline carbonates. Treatment with silicate of potash or soda increased the durability of the coarse canvas tenfold.
—W. R.

Diastatic Action of Malt and its Preparations. Lecoq. Jl. Pharm. Chim., 1922, **25**, 18-25.

Diastatic action of malt is confined to the range 60°—90°C. with optimum activity at about 75°C. The activity of malt itself is 3—4 times greater than that of any of the commercial extracts prepared from it.
—F. C. W.

Testing Materials for Elasticity. Taenzer. Spinner und Weber, 1922, **40**, No.2, 5.

The elasticity of materials is said to be rarely determined, though of considerable importance. The " recovery " of textiles under cool and moderately damp storage is largely a question of elasticity relations. From the elasticity curve, it is possible to decide whether a certain process is disadvantageous to a certain fabric. In determining the elasticity it is necessary to have a type of testing machine which does not prevent the immediate return of the pointer when the load is reduced.
—E. B. A.

Estimation of Arsenic in Fabrics and Colouring Matters. Utz. Color Trade Jl. (from Farben-Zeitung, 1921, p.3044), 1922, **10**, 64.

Practical details are given for the estimation of arsenic in textile fabrics, wall-paper, etc. —L. M. S.

Testing Woven Materials. A. Alt. Textilberichte, 1921, **2**, 414-415, 430-432.

In continuation of the previously abstracted articles (See This *Jl.*, 1921, **12**, 408, 455) the effect of various agents on the strength of paper yarn is described. Oil decreases the strength of paper cord, but if the cord is impregnated with a tar distillate before treatment with oil only a slight decrease followed by an increase is observed. The effect of water and of dirt has also been studied. As regards the effect of frost on the strength of fabrics a table is reproduced showing the results of strength tests of various cloths and paper fabrics after exposure to temperatures of about—15°C. None of the materials examined showed a noticeable decrease of strength after the treatment. Strength tests were also carried out on pieces of cloth which had been boiled in a washing solution of high waterglass and caustic soda content. The results are expressed in a table and graph, but the effect of the treatment was so irregular that it is doubtful if the mean values given have much significance. Graphs and tables are given recording the loss of strength of " Maco " cotton, linen, paper and " Textilose " sail-cloths after steeping in 5% HCl, 10% H_2SO_4, or 10% HNO_3 for various periods, the materials being washed in running water and dried in air before testing. A simple method is given for testing the efficiency of fireproofing. Longer treatment with salts was found to give more efficient protection.—J. C. W.

Hydro Extractor Accidents. Amer. Silk Jl., 1921, **40**, 65.

This form of accident appears to be very prevalent in America, and the principal cause is said to be the human element. Basket deterioration can be readily noticed by applying an electrical test of 2,000 volts to every portion of the basket every three months. Rubber-covered baskets and old-fashioned whizzes are particularly liable to breakage. Improper loading is another cause of accidents. Self-balancing extractors will not cover all mistakes in loading. Defective and fatigued materials also give rise to accidents; bulging of the drum should be looked for. Excessive speed should be avoided; if the normal speed of 42″ basket is 850 r.p.m. and this is increased to 1150 (+40%) the strains are doubled and the safety factor halved. Steam-driven hydros are often overspeeded because their governors are out of order. It is pointed out that centrifugal force is proportional to angular velocity, not peripheral speed, varying directly as the size of the basket and load, and as the square of the speed. Efforts to render the machine fool-proof should be made. Manufacturers should mark all their hydros with the limits of wet load and speed.—F. G. P.

Gas Fastness of Dyeings. II. E. Ristenpart. Textilberichte, 1922, **3**, 27.

The author has already called attention to the necessity for a test for formaldehyde, other than the fuchsin sulphurous acid test. A test is described by R. Cohn in the *Chemiker Zeitung,* 1921, p.997, which the author has tried and found satisfactory and by means of which 0·05 mg. of formaldehyde can be determined. The test is carried out as follows:—2 c.c. of a 0·1% solution of resorcinol are mixed with 2 c.c. of the formaldehyde containing distillate, and 2 c.c. of concentrated sulphuric acid poured into the tube. At the junction, in the presence of formaldehyde, a white ring with a dark violet zone underneath is formed. By means of this test, the author has established the fact that discoloration of stockings and gloves packed in cardboard boxes is due to the formaldehyde contained in the paste used in their manufacture. —E. B. A.

Comparison of the Various Corn Products Starches as Shown by the Bingham-Greene Plastometer. C. E. G. Porst and M. Moskowitz. Jl. Ind. Eng. Chem., 1922, **14**, 49-52.

The use of the results obtained with the plastometer by the authors has many times enabled exact advice to be given as to what product will satisfy a particular requirement. Also it has been used in conjunction with the chemical analysis to tell what product would exactly match a submitted product. —F. C. W.

Cotton; Preliminary Manufacturing Tests of the Official Cotton Standards of the United States for Colour for Upland Tinged and Stained——. W. R. Meadows and W. G. Blair. Bull. 990 of U.S. Dept. of Agric., Oct. 20, 1921.

Low Middling, Good Middling Yellow Tinged, Middling Yellow Tinged, Low Middling Yellow Tinged, Good Middling Yellow Stained, Middling Yellow Stained, Good Middling Blue Stained and Middling Blue Stained cottons selected throughout the cotton belt were tested to determine their relative spinning values. All these grades were subjected to the same mechanical treatment, the conditions being the same as those used on earlier tests of the Official Cotton Standards of the United States for Upland white cotton. The percentage of visible waste followed the grade of the cotton, but the highest grade did not always give the strongest yarn. Bleaching and dyeing tests showed that Middling Yellow Tinged and Low Middling Yellow Tinged when bleached can be used for dyeing both light and dark shades. Low Middling, Good Middling Yellow Tinged, Good Middling Yellow Stained and Middling Yellow Stained can be bleached satisfactorily for white yarns. The Good Middling Blue Stained and Middling Blue Stained can only be bleached satisfactorily for dyeing dark shades. —F. C. W.

Artificial Silk Manufacture; The Scientific Basis of——. K. Hess. Textilberichte, 1922, **3**, 41-46.

The necessity for further work on the constitution of cellulose as the starting point for improvements in the manufacture of artificial fibres is emphasised. Ambrown has shown by means of polarised light that cellulose is crystalline, not amorphous; Herzog and others have shown by Röngten ray analysis that cellulose has a lattice structure, and they regard it as being built up of groups of 4 ($C_6H_{10}O_5$) complexes linked by partial valencies. Therefore it should be possible to depolymerise it by breaking these valencies. It is suggested that soluble derivatives are the result of depolymerisation and possibly of isomerisation as well as specific chemical reaction. By the action of acetyl chloride saturated with hydrochloric acid gas under certain conditions, a completely soluble acetyl derivative is obtained. Molecular weight determinations show it to contain two $C_6H_{10}O_5$ groups. After splitting off of the acetyl groups a body of empirical composition $C_6H_{10}O_5$ is obtained, differing from cellulose only in that its caustic soda compound tends to go into solution in water, instead of being precipitated by water. In strong acetic acid, phenol and naphthalene, molecular weight determinations indicate a tendency to polymerise to a 4 ($C_6H_{10}O_5$) group, thus bringing it into line with Herzog's deductions. The author suggests that elementary cellulose consists of two $C_6H_{10}O_5$ groups linked together by means of four oxygen atoms, one in the 5 position. The position of the other three is unknown, and it is upon these that the properties of cellulose depend. The linking of these 2 ($C_6H_{10}O_5$) groups by partial valencies forms the complex cellulose. —E. B. A.

Linen and Cotton; The Differentiation of——. Spinner und Weber, 1922, No.5, 3.

Eight tests are given for detecting cotton in linen unions. The following appear to be the best and simplest. Ink test:—A drop of ink on pure linen spreads equally in all directions; in the case of unions it spreads more rapidly in the direction of the linen threads because they are more porous. Copper vitriol test:—The sample freed from finishing material is soaked in copper sulphate for 10 min., washed, and then dipped in 10% potassium ferrocyanide. The linen threads become copper coloured, but the cotton are hardly altered. The test is particularly striking if the sample is placed in Canada balsam or oil. Methylene blue test:—The sample is placed in a warm solution of methylene blue and then washed. Only the linen threads are dyed. Safranin or bismark brown can also be used. —E. B. A.

Testing Wool. Indian Text. Jl. (from Rev. de la Filature et du Tissage), 1921, **32**, 81.

An invention for testing wool to determine the length of the staple is mentioned. —L. M. S.

Glycerin; Precipitation of Impurities in Crude—with Lead Hydroxide. Fricke. Chem. Zentr. (from Zt. deuts. Oel-und Fettind., 1921, **41**, 665), 1922, **93**, II., 160.

The method gives constant results, but lower than those obtained by the acetin method. It is, however, useful for technical purposes. —F. C. W.

Dextrose and Sucrose; Monosulphates of——. Neuberg and Liebermann. Biochem. Zeits., 1921, **121**, 326-332.

These are obtained by action of chlorsulphonic acid in chloroform at –10°C. on the carbohydrate dissolved in pyridine. —F. C. W.

Azo Dyes; Electrometric Titration of——. D. O. Jones and H. R. Lee. Jl. Ind. Eng. Chem., 1922, **14**, 46-48.

The difficulties encountered in the analysis of azo dyes with titanous chloride by previous methods are enumerated. An analytical procedure is described whereby the electrometric method of following oxidimetric reactions is used in conjunction with titanous chloride for the successful analysis of azo dyes and nitro compounds. Typical curves for obtaining the end-point are shown, though for routine analysis almost all azo dyes can be analysed with sufficient accuracy without reading the voltmeter or plotting a curve. —F. C. W.

Chemical Action of Sunlight on Dyed Fabrics. Posselt's Text. Jl., 1921, **29**, 68.

An account of recent research on this subject is given and of the study of the fastness to light of benzidine direct cotton colours. —L. M. S.

Identification of Fibres of Animal and Vegetable Origin. Posselt's Text. Jl., 1921, **29**, 91.

Mixed material is treated with acid solution of a nitrite in the dark, washed, and then placed in an alkaline B-naphthol bath containing lead acetate (Lecompte's test); wool is coloured black, silk deep red, while cotton is untouched. It is better to use a solution of lead acetate 2 gram in 50 c.c. distilled water with 2 grams caustic soda in 30 c.c. water. This mixture is boiled till clear and 0·3 gram magenta in 5 c.c. alcohol added after cooling to 60°C. The material is soaked in this and then washed in dilute acid. On drying, the same colours are obtained as above. A modification of the Lecompte test is to boil the material in a solution of 0·5 gram sodium nitrite acidified with hydrochloric acid for a minute, wash and boil in alkaline B-naphthol. Silk and wool are coloured copper-red; cotton is left white. Tussah is said to turn chocolate colour. This difference might be too slight to distinguish accurately; confirmation is obtained by boiling with concentrated hydrochloric or 5% NaOH, either of which dissolve silk but only render tussah transparent. —F. G. P.

Half Shade Photometer. W. Douglas. Textilberichte, 1921, **2**, 411.

This apparatus is devised for expressing the whiteness of a fabric in figures. Chemically pure barium sulphate is taken as standard white. A case is divided into two compartments blackened inside, fitted with binocular eye piece. A Wolf's prism head makes it possible to compare two objects almost without a dividing line. In use, the opening above the normal white is altered until both objects appear to be the same shade. Readings on a scale give the "content" of white. —H. R. H.

Faults in Dyeing Woollen and Worsted Pieces. See This *Jl.* (Proc.), 1922, **13**, 31.

The Stress-Strain Curves of Various Yarns. See This *Jl.* (Trans.), 1922, **13**, 25.

Wool Analysis of a Flock of Highland Blackfaced Sheep. See This *Jl.* (Trans.), 1922, **13**, 40.

The Elastic Properties of Yarns. See This *Jl.* (Trans.), 1922, **13**, 45.

7.—BUILDING AND POWER.

(A)—CONSTRUCTION OF BUILDINGS.

The Legal Requirements in the Equipment of Worsted Combing and Spinning Mills. See This *Jl.* (Proc.), 1922, **13**, 13.

(C)—POWER.

Adjustable Speed Motors and Control in Finishing Plants. C. W. Babcock. Electric Jl., 1921, **18**, 509.

Deals with the application of adjustable speed direct current motors and automatic control gear, to printing machines and tenters, and describes means of running individually driven machines in tandem with an automatic device to keep the motor speeds correctly adjusted relatively to each other. —V. M.

The Central Station and the Textile Mill. F. S. Roat. Electric Jl., 1921, **18**, 487.

Judging by past events, it is probable that in the near future no new textile mill will any more think of making its own power than it would of making its own looms. New England is admittedly conservative in its methods, but since 1911, when a 50,000 spindle mill was erected to run on purchased electric power, the use of this power has increased year by year until there are now 17 mills entirely driven by purchased power, totalling 21,470 HP. and 26 mills each of which purchase from 100 to 1,500 HP., totalling 12,910 HP. All except two of the remaining mills use some central station power. The total power consumption of all the textile mills in the city is about 130,000 HP., and past progress seems to indicate that in seven years all this power will be taken from the central station. —V. M.

Group versus Individual Drives on Wool Cards. A. B. Reed. Text. World, 1922, **61**, 63.

The results of tests taken on two sets of cards are given, firstly with both sets driven from one motor by means of shafting and belts, and secondly with each of the three units of each set driven by a separate motor. Each set consists of 1st breaker, 2nd breaker and finisher, the main cylinders being 60″ dia. by 48″ wide running at 74 RPM., and as a result of tests it was found that the finisher required a starting effort equal to 6·14 HP., the breakers being lighter to start. Six 3 HP. 470 RPM. 25 cycles, 550 Volt motors were installed, and they drive the main cylinders by means of silent chain drives. A comparison of the capital costs gives 1,512 dollars for the group drive, against 2,054 dollars for the individual driving equipment. The tests showed the power consumption, including the motor losses, to be 5·08 HP. per set when group driven, against 4·75 HP. per set when individually driven. —V. M.

Silk Throwing and Electric Drive. C. T. Guilford. Electric Jl., 1921, **18**, 512.

Describes the development of individual electric driving of silk spinning frames. The most modern practice is to use a vertical spindle motor with a pulley or pulleys driving direct on to the spindle belt or belts. This drive eliminates the use of quarter twisted belts and guide pulleys, and it takes up no more room than the pulleys used for driving from a line-shaft. —V. M.

Motors for Textile Finishing Plants. W. B. Lewis. Electric Jl., 1921, **18**, 504.

In cloth finishing plants, power is required for driving machines, pumping water, light, heat for warming buildings, and high and low pressure steam for boiling and drying. In a well-designed plant, all the heat put into the power plant can be recovered and used. This can be done to some extent by the old method of using small individual back pressure engines to drive the variable speed machines and turning the exhaust steam from these engines into a low pressure main. The modern adjustable speed motor, however, gives a much better speed control than the small engine; it enables all the power to be produced in one main unit, the whole of the exhaust steam from which can be used in the processes. By studying the varying characteristics of the machines to be driven, the motors can be specially adapted for their work and the requirements of speed control can be most effectively met, especially by using automatic push button control gear. For this class of work the direct current motor is supreme, and many plants having alternating current generators and alternating current motors for their constant speed drives, convert to direct current for driving their variable speed machines. —V. M.

Steam Extraction. T. B. Morley. Manchester Guardian Commercial, 1921, **4**, 207.

In factories using steam both for power production and for process work, it is seldom appreciated that large savings can be effected by using the same steam for both purposes. For example, a factory using 200 HP. and 3,400 lbs. of steam per hr. for processes and equipped with a condensing engine using 11 lbs. of steam per HP. per hr. will have to raise a total of 2,200+3,400=5,600 lbs. of steam per hr. If a single cylinder engine were used exhausting at 5 to 10 lbs. per sq. in. it would require, say, 18 lbs. per HP. per hr. and hence only 3,600 lbs. of steam per hr. would have to be raised as compared with 5,600 lbs. In practice the demands for power and for process steam generally fluctuate widely, and these conditions are met by using an "extraction" engine or turbine. These are of the condensing type, but are arranged to pass out steam between the high and low pressure stages, the engine or turbine automatically adjusting itself to the demand for steam. By using an extraction engine, the steam consumed for power purposes can be reduced to a very low figure, and as regards capital cost the increased cost of the engine is more than balanced by the decreased cost of the smaller boiler plant. The combination of heat and power supplies is one of the most practical means of solving the problem of fuel economy. —V. M.

The Textile Industry in the South. J. Gelzer. Electric Jl., 1921, **18**, 491.

The industry is exclusively cotton, and there are now 16,000,000 spindles installed. Electrical driving first started in 1894; in 1905 5% of the power used was electric; it is now 50%. There is a growing tendency towards individual drives, and whereas the average size of motor installed was 50 HP. in 1912 it was only 4 HP. in 1919, and it will probably be about 3 HP. in 1922. Illustrations and also actual power consumption curves are given for individually driven scutchers, cards, combers, spinning frames and looms. The scutcher is belt driven from a motor fixed on a frame bolted on the top of the machine. The card is gear-driven, the ring frame chain driven, and the loom gear driven. A table of machine power consumption is given. —V. M.

Belt Drives and Machine Design. J. L. Alden. Text. World, 1922, **61**, 77.

The character of belt drives to machines is very often determined by the machine maker, who constructs his machine with a driving pulley of a certain specific size intended to run at some specific speed, and alterations are often impracticable. Unfortunately many machine makers do not pay sufficient regard to the belt drive, and very low belt speeds are commonly found even on machines where this could be easily avoided. Higher belt speeds would eliminate trouble and save expense on many machine drives. —V. M.

A New Form of Gear. Engineering World, 1921-22, No.58, 17.

In a paper given before the Institution of Engineers and Shipbuilders in Scotland, Mr. W. Rus Darling describes a new auto-pitch gear, the feature of which is that the pinion has no permanent teeth. The idea is that the periphery of the pinion should have the properties of a fluid in which the teeth of the engaging wheel will continuously make their own indentations. An actual fluid being impracticable, the pinion is constructed with a multitude of small diameter rollers forming the periphery, into which the teeth of the engaging wheel bed themselves. The rollers adapt themselves to any form of wheel tooth, and they fill the spaces between teeth, thus giving a large number of lines of contact. The same pinion can work with two wheels of different pitches simultaneously. The pinions in use so far have been successfully applied to surmount difficulties which had seemed insuperable. Efficiency figures are not yet available. —V. M.

Individual Motor Drive for Spinning and Twister Frames. G. Wrigley. Electric Jl., 1921, **18**, 501.

The general acceptance of individual driving of these frames has been delayed through lack of a satisfactory transmission medium between motor and machine. Couplings and friction clutches have the disadvantage of not allowing any speed adjustment and gears proved only partially satisfactory. The silent chain, using ½″ pitch, about 10″ centres, a chain speed of about 1,500ft. per minute, and motor speed of 1,750 RPM. has proved satisfactory and become standard. It is a fallacy to expect higher room temperatures with individual drive; this drive is as efficient as any, and the amount of heat produced cannot therefore be greater. The motors themselves feel warm because the heat emanates from a comparatively small surface. A diagram is given showing the power taken by the different parts of a spinning frame, as obtained from tests. —V. M.

Low Temperature Carbonisation. Manchester Guardian Commercial, 1922, **4**, 271.

The Sutcliffe Speakman process of low temperature carbonisation depends on the fact that powdered coal mixed with about 20% coke breeze can be briquetted without using a binder, and that these briquettes can be carbonised at any temperature without expanding. It is claimed that existing gasworks retorts can be used for the process. One ton of coal will yield 10,000 c. ft. of gas of standard 550 B.T.U. quality, 20-25 galls. liquid products and 35-40 lbs. ammonium sulphate. The residual fuel resembles charcoal, is as hard as anthracite, burns well in an open grate and is smokeless. The cost of the process is given as 5/- per ton of coal carbonised. —V. M.

The Design of Induction Motors for Textile Service. O. C. Schoenfeld. Electric Jl., 1921, **18**, 496.

The two troublesome factors which were encountered when motors came to be installed inside textile workrooms were lint and humidity. The lint choked up the air passages of the motors and interfered with the bearing oiling arrangements. These troubles have resulted in the use of dustproof bearings and, as regards large motors, in liberal ratings rather than means of excluding the lint. Smaller motors are provided with screens of perforated metal or are made totally enclosed. Humidity troubles have been overcome by means of special insulating compounds. The four frame drive of spinning and twisting frames was an advance on large group driving, but individual driving has established its superiority. The individual drive motor is specially designed to give a starting effort which is sufficient for the frame and yet not so great as to cause yarn breakages. The chain is now recognised as the best driving medium, and the machinists, chain and motor makers have recently standardised the shaft and sprocket sizes and the spinning frame bracket for carrying the motor. —V. M.

Compounding the Internal Combustion Engine. E. A. Sperry. Mech. Engineering, 1922, **44**, 27.

The Diesel engine has the highest fuel economy of all prime movers, but its weight and cost are greater than those of steam plant, and it requires a partially refined oil which costs more than oil for steam raising. It has been recognised for some years that successful compounding of the Diesel engine would bring great advantages, but now the principle has been thoroughly established and an engine embodying it subjected to long runs. The compound engine is light, being in special cases less than one-tenth the weight of the normal Diesel engine, and gains have been made in fuel efficiency, simplicity, and smoothness of turning. The result will inevitably be lower cost and the possibility of larger units. The division of the expansion and also the compression into two stages increases efficiency by permitting expansion ratios as high as 120 to 1 and improves combustion by reason of the relatively large combustion chamber. Early attempts at compounding failed principally on account of transfer losses between the cylinders and the manner in which these difficulties have been overcome is described. Indicator diagrams and a drawing of the engine are given, and technical points are discussed. —V. M.

Some Experiments on the Production of Power Alcohol and Paper Pulp from Megasse. See Section 6.

(D)—LUBRICATION.

Lubrication of Steam Cylinders without Oil; The——. Engineering World, 1922, No.57, 6.

The lubrication of steam cylinders with oil is attended by many disadvantages such as carbonisation, combination with impurities in the steam to form deposits, and presence of oil in the exhaust steam. These difficulties can be eliminated by lubricating with defloculated graphite, the particles of which are of such minuteness that they will remain suspended in distilled water. This lubricant may be admitted to the cylinder directly, or preferably by the atomiser method. —V. M.

(E)—TRANSPORT

Material Handling at Mt. Hope Finishing Co. J. W. Synan. Text. World, 1922, **61,** 66.

Describes the putting into operation of eight electric battery trucks for doing all the factory transportation. Five of the trucks are of the tractor type, and are used to haul the old hand trucks, whilst three are of the elevating type and move material loaded on to skids. The trucking service is controlled by one department, which charges all other departments on the basis of services actually rendered. It has resulted in great economy due to labour saving. —V. M.

(F)—LIGHTING.

Day and Night Lighting in Textile Mills. S. G. Hibben. Electric Jl., 1921, **18,** 515.

In purchasing lighting fixtures it is important to choose them for the results they give, and to pay for illumination rather than glass and metal ware. The intensity of light falling on a surface is measured in foot-candles by a foot-candle meter, and the quantity of light falling on a surface is equal to the intensity in foot candles multiplied by the area of the surface in sq. ft.; this product is spoken of as so many lumens of light. Lighting cost is therefore truly expressed in cost per lumen. Cardinal points governing lighting are:—Minimum permissible illumination is 2 foot candles for average work and 3 for discrimination of detail, but it is usually profitable to exceed these values materially; bare lamps mean reckless waste of light and cause glare; efficiency depends on correctly shaped reflectors; glare is not only uncomfortable but it prevents a man seeing distinctly; light-coloured ceilings and walls have a real value, since dark surfaces absorb light, which costs money; frequent cleaning of lighting equipment pays; lamps should be run at their rated voltage; lights should be connected in rows parallel to the windows; natural daylight falls in value very rapidly as one moves away from the windows, and it also changes greatly with the hour—curves are given to show these changes; the colour of daylight changes from hour to hour and colour matching is affected by this. —V. M.

Artificial Daylight. Text. Recr., 1921, **39,** 73.

It has been commonly assumed that accurate colour matching can only be done by daylight, and as this forms a serious restriction attempts have been made to produce artificially a light with the same qualities as daylight. Among devices of this kind are the Dufton-Gardner lamp and the Moore tube lamp, but for use on an extensive scale it is desirable to use an incandescent gas-filled electric lamp. This lamp, like most artificial illuminants, has too much red and too little blue in its spectrum, and it is necessary to correct this defect. The simplest method is to filter the light through specially tinted glass, and such glasses are made. An alternative indirect method of reflection is used in the newly introduced Sheringham Daylight, the reflector being tinted with red, green and blue in a special pattern. There is, of course, some loss of efficiency by absorption of light. As yet there is no standard with which to make comparisons, since natural daylight varies considerably; it is moreover modified by the surfaces of many rooms which are used for colour matching, and this suggests that excessive accuracy in imitating daylight is not essential. —V. M.

(H)—HUMIDIFICATION.

Ventilation and Humidification. See Section 7I.

(I)—VENTILATION.

Ventilation and Humidification. F. Hoyer. Leipzig. Monatsch. Text. Ind., 1921, **36,** 181.

A discussion of the general principles of ventilation and humidification. The various methods in use are briefly compared. Figures are given for the heat developed and carbon dioxide given off by various sources of light. —J. C. W.

PATENTS

Humidifying Spinning and Weaving Works. Esnault-Pelterie. F.P.515,502. Appl. 14/5/20.

The current of air is humidified by a rain of an aqueous solution of which the vapour tension is equal to the required fraction of the vapour tension of pure water. The delivery of this rain is very copious in order that the air, at its outlet of the pulverisation apparatus, is charged with water vapour at the tension of vapour of the liquid. The liquids used for this purpose are solutions of sodium, calcium and magnesium chlorides. —Bur. Text.

8.—DESIGN.

Technology of Textile Design. See This *Jl.* (Proc.), 1922, **13,** 34.

9.—COMMERCE, ECONOMICS, LABOUR, ORGANISATION, COSTING, &c.

Rents for Room and Power: A Plea for Accurate Costings. Wool Rec., 1922, **21**, 169.

As a basis of fixing the rent for room and power for various classes of machinery the following suggestions are put forward:—Buildings, minimum rate of interest, 7½%; depreciation on buildings and repairs, 5%; ground rents, rates and taxes, 2s. per sq. yd.; insurance on premises, 6s.% on value of premises; heating, 6d. per sq. yd.; power, £12 per horse power per annum based upon a coal price of 25s. per ton. A calculation is given based upon premises covering 600 sq. yds. which works out at 7s. 1½d. per sq. yd. per annum unheated and 7s. 7½d. per sq. yd. heated. Another calculation for room and power for a twenty power loom plant with accessories works out at £23 8s. 7d. per loom per annum. —F. P.

Waste in the Textile Industry. W. R. Bassett. Wool Rec., 1922, **21**, 106.

Waste is said to be occasioned by intermittent operation, complete shutdowns, loss of less than capacity machine operation, unbalanced plants and poorly planned operation. It is estimated that the textile industry produces less than 40% of the output possible from its existing facilities. Collective selling of many standard lines will eliminate certain distribution costs. The collective buying of commodities will enable individual firms to carry less stock, thereby economising capital. —F. P.

Silken Strands. Times Trade Supp. (Industrial Yorks.), 1922, **9**, 20.

The silk industry of the West Riding of Yorkshire is alluded to, and artistic merit is said to be very high. There is a growing export trade, especially of striped goods, in spite of foreign tariffs. Silk-pile cotton-backed fabrics, silk and mohair plush and artificial furs and figured fabrics are produced. Much weaving of English artificial silk is also done in Yorkshire. The soft feel of Yorkshire silks is said to account largely for their popularity not only in the Dominions and Latin-America but also in the United States and Japan. —F. G. P.

Canada: Cotton and Woollen Industries in 1921. Bd. of Trade Jl., 1922, **108**, 160.

H.M. Senior Trade Commissioner at Montreal reports a decided improvement in the Canadian cotton trade during 1921. At the beginning of the year only 681,012 out of 1,100,000 spindles were running; by the end of June the number had increased to 968,110. By the close of the year the demand for cotton goods had increased to such an extent that nearly all mills were running full time, and several had adopted a shift system that enabled them to operate on a 24 hr. basis. Improvement is also reported in the woollen industry, although this is not so marked as in the case of the cotton industry. —F. C.

Development of Artificial Silk in America. Amer. Silk Jl., 1921, **40**, 63.

The name of the material is objected to in America, and there has been legal injunction against the use of the word "silk." "Fibre-silk" is also objected to, as the material has no reference to silk. It is stated that American production is slowly but steadily overtaking the demand, but no useful figures concerning quantities used and made recently are given. —F. G. P.

International Conference on Vocational Guidance. Jl. Nat. Inst. Ind. Psychology, 1922, **1**, 15, 18, 32.

The work of the Barcelona Institute of Vocational Guidance is described by Dr. Myers. The Institute, which has been established 12 months, is divided into four departments:—the medico-anthropometric; the psycho-metric; the statistical; the information departments. At present the work of the Institute is limited to vocational guidance. —F. C.

Wastes in Textile Plants; Hidden——. T. P. Gates. Textile World, 1922, **61**, 95.

Examples are given of savings which have been effected in various departments of mills as the result of laboratory research. In a bleaching house with the newest plant the chemical side was found to be capable of improvement to afford a 50% increase in output with only a slight increase in water and chemicals. In another department two strands of cloth were run side by side in the machine in place of one enabling a 50% increase of production. In a worsted spinning plant it was found possible to replace 25 individual type dollies which required a worker each by one continuous scouring machine or at most two machines requiring but one operative each with greatly reduced cost of soap and scouring agents. —W. D.

The Principles of Organisation and Management. See This *Jl.* (Proc.), 1922, **13**, 19.

Industrial Fatigue Research Board. Proposals for Development of Investigatory Work in Relation to the Textile Industries. See This *Jl.* (Proc.), 1922, **13**, 24.

Cotton Industry Prospects for 1922. See This *Jl.* (Proc.), 1922, **13**, 30.

Report on the Indian Piece Goods Trade. See This *Jl.* (Proc.), 1922, **13**, 31.

10.—MISCELLANEOUS.

Wool Rendered Moth-Proof by Means of Eulan-F. C. R. Hennings. Text. Colorist, 1922, **44**, 91.

Eulan can be applied in re-dyeing garments to give them a moth-proof finish and to carpets and furnishing fabrics, horse-hair, etc. Details of the method of application to piece dyed goods or yarns are given. —L. M. S.

ABSTRACTS

I.—FIBRES AND THEIR PRODUCTION.

(B)—ANIMAL.

Silk Culture; Progress of China's——. Amer. Silk Jl., 1922, **41**, 74.

Some progress is being made by the International Committee for Improvement of Sericulture. Bamboo wattles are superseding straw for cocoons. Paper trays have given way to cloth, which is less expensive because it can be washed and used again. The committee's cocoons are free from disease, and its mulberry trees will yield all the required food next year. —F. G. P.

China's New Raw Silk Industry. Amer. Silk Jl., 1922, **41**, 55.

White raw silk, wound in the homes of the growers, comes from the interior provinces, the best from Chekiang; tsatlee is reeled in Huchow. Export is declining, partly because the efforts to stop the ravage of "fibrine" in silk are not very effective and partly because internal consumption is increasing. The amount of filature silk produced is increasing, and is sent chiefly to France, America, and Italy. Notes of the methods of buying and the names of the principal export firms are given. —F. G. P.

Improvement of the Wool Clip. G. A. Brown. Michigan Agric. Coll. Expt. Sta. Quarterly Bull., 1920, **3**, 6-7.

Refers to the co-operative marketing and grading of wool. The characters on which the grading is based are given, and the factors determining the qualities are briefly referred to. —W. R.

Wild Silk Moths of Nigeria; The Irritating Hairs of the——. A. W. J. Pomeroy. Bull. Imp. Inst., 1921, **19**, 311-318.

The irritation produced by these insects is not due to the larvel hairs found in the nests, but solely to hairs from the end of the abdomen of the moths, these hairs being left in the nests by adults finding difficulty of egress or drying in the interior. The larval hairs of two sorts are minutely described and figured, as are also those responsible for the irritation from the abdomen of the female moth. Methods for preventing the presence of the hairs in the marketed material are described. —W. R.

British Strong Wools. Wool Rec., 1922, **21**, 33-34.

It is suggested that English wool growers have sacrificed wool quality by paying too much attention to the carcase, as samples of English Lincoln wool when compared with Colonial Lincoln wool showed up very unfavourably. —F. P.

Wool Growers' Association in South Africa. Text. Merc., 1922, **66**, 238.

Combinations of sheep farmers in districts in the Cape Province, to be known as the Wool Growers' Associations, have been advocated at Graaf-Reinet by the principal of the Agricultural College, who urges that at the shearing season experts and wool students take charge of the operation in sorting and classing all the clips on definite lines and endeavour to sort according to spinning counts. This, he says, could be done with a combination of clips, say, 2,000 to 5,000 bales.—L. M. S.

Cheviot Sheep; Pure-bred——. Wool Rec., 1922, **21**, 29-31.

Careful selection has gradually evolved an improved animal and a better quality of wool. The earlier type produced a fleece weighing only 2lbs. composed of fine wool mixed with fine white bars. The kemp has now been entirely bred out. A ram will clip 10 to 12 lbs. of fairly fine wool densely grown and of an equal quality, and a flock of hill sheep should clip an average of 4½lbs. per head. —F. P.

Sheep Breeding in Algeria; On the Extension and Improvement of——. G. Tronette. Bull. Agric. Intell. (from La Vie Agric. et Rurale, 1921, **18**, 200-301), 1921, **12**, 614.

Algerian flocks are classified in relation to districts, the relation of extending colonisation to the grazing and breeding industry is discussed, and in the case of the southern less cultivated regions the factors at present limiting the industry are dealt with. The author advocates special methods for improving and extending sheep rearing and breeding in Algeria. —W. R.

(C)—VEGETABLE.

Hibiscus cannabinus. Bull. Imp. Inst., 1921, **19**, 389-391.

Refers to a comprehensive article on this plant, otherwise known as Deccan hemp (Bull. de L'Agence Gen. des Colonies, 1921, **14**, 341 and 473). The plant covers large areas in French West Africa. The forms recognised by the natives are described, and details regarding cultivation, propagation and retting are furnished. The fibres have been studied as regards microscopical characters and tensile strength in connection with different methods of retting. The organisms concerned in the retting have also been studied and are described. Chemical and mechanical methods of decorticating and degumming are dealt with, and the properties of the fibre are compared with those of jute. A bibliography is given in the French paper and also illustrations. —W. R.

Flax; On the Value and Possibility of a Machine Method of Raising the "Thousand Grain" Weight of Seed—. H. Kappert. Faserforschung, 1921, **1**, 211-222.

Refers to the extraordinary variability met with in the weight per 1,000 seeds of different varieties of flax from different districts and countries. It is shown that samples show corresponding variations in seed length and breadth, and that by passing through a sieve machine with suitable meshes the uniformity can be raised and the weight per seed increased, and, further, the percentage purity of the seed is raised, although the percentage power of germination is not appreciably altered. This increase in the seed weight is equal to about 15 to 20%. —W. R.

Hemp Fibres; On the Forked Ends of——. Willi Müller. Faserforschung, 1921, **1**, 246-254.

Reviews the literature on the ends of fibres. The varieties of ends seen in fibres of hemp are described. In many cases the forking is entirely absent, and it is held that the number and form of the forkings afford criteria for determining the geographical origin of the hemp. It is pointed out in confirmation of Von Höhnel that the ends of flax fibres also occasionally show forking which may be a critical character. —W. R.

The Bundelkhand Cottons: Experiments in their Improvement by Pure Line Selection. B. C. Burt and N. Hyder. Agric. Res. Inst., Pusa, 1921, Bull., No.123.

A survey has been made of the most important commercial cottons of Bundelkhand. These have been grown and examined in detail, and pure lines isolated and tested. The best of these, which yields well in the field, has a lint length of ⅞in., and is good for 16's to 18's warps and 20's wefts as compared with 10's to 12's for ordinary *deshi* cotton (*Bengals*). These results have been confirmed by actual spinning trials. About 1,000 acres of this cotton were grown in 1920, and it is distinguished by its high yielding power in wet seasons. The leaf is broadly lobed, the bolls are larger than those of *deshi* and the habit is characteristic. It is suitable both for irrigated and non-irrigated sowings. —W. R.

Arizona Wild Cotton or Thurberia and its Insect Enemies. A. W. Morrill. Jl. Econ. Ent., 1921, **14**, 472-478.

The presence of Thurberia in Arizona constitutes a serious menace to the Arizona cotton industry, since it harbours the dangerous Thurberia boll-weevil recently found infesting cotton. Elaborate precautions to prevent the spread of the pest are described, and the narrow non-cotton zones which have officially been established are severely criticised as futile in arresting the progress of the weevil. —W. R.

Soil Sourness: Its Meaning and Significance. F. Hardy. West Indian Bulletin, 1921, **19**, 37-85.

A comprehensive survey of the modern work on soils in relation to acidity. The theory of soil acidity is dealt with first, and then in order the following:—The relation of true soil acidity to plant growth; the deficiency in calcium compounds as a factor in sourness; the toxicity of aluminium, iron, and manganese; the absence of adequate aeration as a factor in soil sourness. There is a bibliography of 79 papers, and the article should be of great service to students and workers on soil problems in the West Indies and generally. —W. R.

Studies in Soil Reaction. E. A. Fisher. Jl. Agric. Science, 1921, **11**, Jan.

A paper similar in scope to the foregoing, which, however, gives a fuller discussion of the physico-chemical interpretation of soil acidity. —W. R.

Cotton Growing Prospects in Ceylon. Times Trade Supp., 1922, **9**, 485.

It has been reported that the "black cotton soil" in the Mannar district, which covers some 16 sq. miles, is equal to the cotton soil of the Madras Presidency and the lesser cotton soils of America. It is estimated that working 10,000 acres on a two years' rotation basis, or laying out half the whole area under cotton at a time, 1,500,000lb. of cotton could be obtained from each crop. During the Christmas rainy season 10 acres were planted at Kiula and 50 acres at Ambalantota with Cambodia, Egyptian, Upland, Sea Island and Indian cotton, and upon the results of these experiments will depend the extension of the cotton-growing area in the Tangalla and Hambantota districts. —L. M. S.

Insect Pests and Diseases in W. Indies, 1919. West Indian Bull, 1921, **19**, 18-37.

Notes are given on the occurrence of a number of pests of cotton in the various islands. The list includes cotton worm (*Alabama argillacea*), boll worm (*Heliothis armiger*), cotton stainers (*Dysdercus* spp.), bush bugs (*Nezara viridula* and others), black scale (*Saissetia nigra*) and white scale (*Hemichionaspis minor*), flower bud maggot (Contarinia gossypii), leaf blister mite (Eriophyes gossypii), a few other insects, such as mealy bug (*Dactylopius*), which caused severe damage on one estate in Montserrat. Notes on the methods of control used are given in some cases. There are also a few notes on parasitic insects which feed on the cotton worm (p.31). Of fungal diseases those dealt with are soft rot of bolls (*Phytophthora* sp.) and W. Indian leaf mildew (*Ovulariopsis gossypii*, Wakef.). The three bacterial diseases—bacterial boll diseases (external and internal) and the angular leaf spot—all occurred, but did not in any case cause serious damage. —W. R.

Pink Boll-Worm in Brazil; Combating the——. Experiment Sta. Rec. (from Bol. Min. Agr. Indus. e Com. Brazil, 1919, **8**, 93-102), 1921, **45**, 554.

A loss of 70% was reported from one State; carbon disulphide and hot water are used for seed infection. —W. R.

Flax Rust; Contribution to the Life History and Mode of Attack of the——. F. Tobler. Faserforschung, 1921, **1**, 223-229.

Describes the mode of action of *Melampsora lini* on its host plant, the flax. The bast fibres are attacked and the substance of their walls destroyed. This is followed by their almost complete obliteration. The effects of the fungus resemble those produced by the attack of pectic bacteria. The straw of flax which is badly attacked by the rust fungus is completely useless. —W. R.

Cotton Cultivation in Somaliland. Times Trade Supp., 1922, **9**, 487.

A zone of about 15,000 acres in the rich and fertile valley of the River Uebi Sceberi will be prepared. Several thousands of acres of woods are now being cleared for the cultivation of cotton, kapok, etc. A large artificial lake which will serve as a reservoir for irrigation purposes is being constructed. In 1925 it is proposed to start the fertilisation also of the zone on the right of the river, and this will be given over entirely to cotton, the type contemplated being Egyptian of long fibre. —L. M. S.

Cotton from French Colonies. Times Trade Supp., 1922, **9**, 487.

The Association Contonniére is proceeding with its attempts to grow cotton throughout the French Colonies, and these have, so far, been most successful. The association now has 30 plantations and ginning factories in French Equatorial and West Africa, Somaliland, Madagascar, Algeria, Morocco, New Caledonia and the New Hebrides. Three plants installed in the Middle Niger Basin are capable of dealing with 10,000 bales (of 440lb.) annually. The association's efforts are now to be concentrated upon a seed farm. —L. M. S.

Notes on New or Little Known Plant Diseases in North Carolina in 1920. F. A. Wolf and S. G. Lehman. Experiment Sta. Rec. (from N. Carolina Sta. Rpt., 1920, 55-58), 1921, **45**, 443.

Among diseases of other crops refers to a root mould of cotton caused by *Penicilium spiculisporum*. —W. R.

Preliminary Note on the Infestation of Hibiscus esculentus Pods by the Pink Boll-Worm. L. H. Gough. Experiment Sta. Rec. (from Bull. Soc. Ent. Egypte, 1918, **11**, 79-83), 1921, **45**, 759.

Gives tables showing the percentage infestation of Okra by pink boll-worm at various periods of 1918. —W. R.

Lime for Soils in the Cotton Belt. Georgia Expt. Sta. Bull., 1922, No.134.

Liming has not been found profitable for cotton farming in the past, but many of the crops now used in rotation with cotton render liming a necessity. —W. R.

Dusting Cotton for the Control of Boll-Weevil. M. C. Tanquary and H. J. Reinhard. Experiment Sta. Rec. (from Texas Sta. Circ., 1921, No.29, 3-9), 1921, **45**, 458.

Refers to experiments in dusting with hand guns and a traction duster using calcium arsenate. —W. R.

Cotton in the Philippines. R. B. Espino. Experiment Sta. Rec. (from Philippine Agric. Rev., 1920, No.3, 186-210), 1921, **45**, 738.

A compilation giving notes on varieties cultivated, with particulars regarding diseases and pests, and cultural and field practices. —W. R.

Swedish Flax Improvement. N. Sylvén. Experiment Sta. Rec. (from Sveriges Utsädesför Tidskr., 1921, **31**, 57-69), 1921, **45**, 738.

Report results of flax improvement work conducted at Svalöf. —W. R.

Cotton in Bulgaria; Production of——. Text. Merc., 1922, **66**, 238.

In parts of Bulgaria, notably the district of Haskovo and Hamanly and certain portions of Bourgas and Glovdiv, the climate is said to be favourable. The production and surface cultivated from 1905 to 1920 are given. Efforts are being made to extend cultivation, particularly in the northern districts. —L. M. S.

Canadian Flax and Linen Industry; The—. W. L. Turner. Text. World, 1922, **61**, 3, 19, 59.

The industry is described from its beginning. The future is discussed, especially in regard to labour and machinery, and an account is given of the various methods of de-seeding, breaking, scutching, and retting in use. —W. R.

Pink Boll-Worm in the United States. Agric. News, W. Indies, 1921, **20**, 394.

The authorities in Texas and Louisiana propose to try a two year non-cotton period as a means of exterminating the pest in Cameron Parish, Louisiana. The main object is to ascertain if two years or a longer time is necessary to ensure absence of the pest. —W. R.

Cotton in West Indies and U.S.A. Bull. Imp. Inst., 1921, **19**, 393-394.

Refers to the account of the progress of the cotton industry given in the Rept. Agric. Dept., St. Kitts Nevis, 1919-20, and to U.S. Dept. Agric. work on cotton. Meade cotton, which is replacing Sea Island, is described and its advantages pointed out; the results of comparative tests between Meade and Sea Island cottons are recorded —W. R.

Flax Seed Propagation Work, 1921. Jl. Dept. Agr. and Tech. Instruction for Ireland, 1922, **21**, 470-476.

Describes pure line cultures with flax on small plots and a number of large-scale variety tests. The aim of the latter was to compare pure lines of flax from various sources and to test the influence of change of habitat on flax seed. The results are summarised in tables. —W. R.

Indian Jute. McLeod, Sir Chas. Bull. Agric. Intell. (from Asiatic Review, 1921, **17**, 302-6), 1921, **12**, 555-6.

Particulars are given of cultivation in India in regard to soils, manuring, species, periods, and methods of harvesting and of the packing and marketing. The economic uses of the fibre are also referred to. —W. R.

Cotton on Jalgaon Farm. P. C. Patil. Bombay Dept. Agric., 1921, Bull. No.108, 1-32.

The chief object of this seed farm is large-scale production of pure seed of cotton. Various other trials have also been carried out. The report gives particulars of maximum and average yields of cotton and other crops and the relation of rainfall to these. Variety and manurial trials are described, and the results summarised in tables. —W. R.

Bast Fibres; On the Inner Structure of——. H. Reimers. Textilberichte, 1921, **2**, 367-368 and 381-383.

Briefly refers to previous work on the physical, chemical, and microscopical structure of bast fibres. The finer structural units are regarded (following Naegeli) as amicroscopic crystals, and the polarisation effects are attributed to these. Experiments using Laue's methods of the analysis of crystal structure by Rontgen rays are described which are held to confirm this view of the crystalline structure of the fibres. These experiments have not, however, thrown any fresh light on the arrangement of the crystals in the fibres. The properties of the different layers of the cell walls of a number of fibres (*morus*, flax, hemp, willow bast, and *Vinca*) are described. —W. R.

Cotton Cultivation in Cambodia. L'Ind. Textile, 1922, **37**, 10.

Two types of long staple cotton cultivated on the red lands of Cambodia have been tested on an industrial scale. In one case, the cotton was clean, white, of woolly appearance, and rather coarser and more brittle than American fibre. Its average staple length was 25-26 mms. The second cotton had an average staple of 23-25 mms., and was slightly yellow in tint. These cottons give yarns comparable with those obtained from American cotton, but their use is limited to production of coarser counts. It is recommended that finer Cambodian cottons, improved by selection and crossing, should be cultivated. —J. C. W.

New Zealand Hemp. Bull. Imp. Inst., 1921, **19**, 392-393.

Refers to a valuable and well illustrated article on *Phormium tenax* and the fibre industry of New Zealand by E. H. Atkinson (New Zealand Jl. Agric., 1921, **22**, 8, 203, 283, 347), in which a historical sketch is given and the development of the industry is traced. The botany of the plant is dealt with fully, and a chapter is devoted to methods of conserving and cultivating the crops. The best methods of harvesting and of propagating the plant are described, and the final chapter deals with the processes used in the extraction and preparation of the fibre for market. —W. R.

Cotton Plant Flowering Curve. J. A. Prescott. Annals of Botany, 1922, **36**, 121-130.

Numerous flowering curves of the Egyptian cotton plant are given. A number of the curves have been obtained at the Bahtim Experimental Station, and relate to cotton under many different conditions of experiment. Reference is made to the similarity between growth processes and autocatalysis and to certain mathematical equations by which the summation curve (total flowers per plant up to the date given) can be expressed with considerable accuracy. —J. C. W.

Cotton Linters; Purification of——. W. Stark. Chem. & Met. Eng., 1922, **26**, 167-169.

The plant used for the purification of cotton linters and hull fibre for the manufacture of guncotton and various pyroxylin products is described. The crude material is digested with dilute caustic soda, the steam pressure in the digester being 65lbs. per sq. in., and the cooking proceeds for 5 hours. The charge is submitted to three successive washings in tanks and then transferred to the bleach tanks. Bleaching proceeds for 3 hours at 30°C. and sufficient chlorinated lime is added to produce perfectly white cellulose. The cellulose is then dried by means of Sargent continuous apron driers. Using 60% linters and 40% hull fibre, 5,000lbs. of crude material yields about 3,500lbs. of purified cellulose. —J. C. W.

Five-Lock Cotton Boll; Frequency of——. H. Dunlavy. Jl. Amer. Soc. Agronomy, 1921, **13**, 332-334.

The frequency and importance of five-lock bolls in cotton is discussed. A table is given showing the percentage of five-lock bolls at the first, second and third pickings of twenty-four rows of Acala cotton grown in Texas. The highest percentage is found in the first picking and the lowest in the last. The average of all plants at all pickings was 73·38%. No variety of American cotton produces 100% of five-lock bolls. The desire of planters for a cotton that will produce a high percentage of five-lock bolls is due to the fact that they are heavier than four-lock bolls. —J. C. W.

Flax; Contribution to the Knowledge of the Pectic Substances of——. See Section 6.

Empire Cotton Growing Corporation; First Annual Meeting of——. See This *Jl.* (Proc.), 1922, **13**, 50.

(D)—ARTIFICIAL.

Viscose Silk; Composition of——. See Section 6.

PATENTS.

Weevil-exterminator. Charles C. Roe, Wolfe City, Tex. U.S.P.1,400,459, Dec. 13, 1921. Appl. 2/11/20. (4 claims: 1 printed.)

The apparatus has a supporting frame and wheels for supporting the frame in standing relation with a row of cotton plants, the frame having a suction device with a main nozzle supported by a tongue over the tops of the plants in the row traversed. —T. W.

Cotton Harvester. Burrell Cannon, Longview, Tex. U.S.P.1,400,522, Dec. 20, 1921. Appl. 29/7/20. (5 claims: 1 printed.)

Comprises a fan, a scoop, gathering devices, and means for setting the devices in operative position to be drawn along a row of plants. —T. W.

Cotton Scraper. James D. Ramsay, Tishomingo, Miss. U.S.P.1,400,982, Dec. 20, 1921. Appl. 13/8/20. (2 claims: 2 printed.)

An attachment for agricultural instruments consists of an open blade substantially V-shaped at its forward edge and disposed with its opening facing the implement. —T. W.

Cotton Picking Machine. Edgar P. Hayes, Dillon, S.C. U.S.P.1,401,076, Dec. 20, 1921. Appl. 10/5/20. (14 claims: 14 printed.)

Embodies a pair of pivotally mounted vertically disposed frames, a plurality of vertically movable rotatably mounted picking spindles in each of the frames, means including a driving gear common to both frames, means whereby the spindles of each frame will be disposed in a forwardly inclined position during their downward movement to pick the cotton, means for stripping the spindles during their upward movement and means for transferring the cotton from the stripped spindles to a receptacle.—T. W.

Scutcher for Hemp. A. Shelly. F.P. 515,443. Appl. 12/5/20.

Comprises one or several rotary scutchers which beat the hemp stricks against the edge of a fixed frame and one or several counter-scutchers, parallel to the first, which beat the stricks on the opposite side. —Bur. Text.

Lint-cotton-treating Machine. Hugh Pettit, Memphis, Tenn. U.S.P.1,401,439, Dec. 27, 1921. Appl. 8/9/20. (5 claims: 1 printed.)

Comprises a saw cylinder having the spaces filled to substantially the base of the teeth, means for feeding cotton to the cylinder, an air blast nozzle directed against the cylinder in a direction opposite the direction of rotation of the teeth for holding the cotton on the teeth and freeing it from dirt, etc.; a second air blast nozzle directed against the cylinder in the direction of rotation of the teeth and at a higher velocity than that of the teeth for discharging the cotton therefrom, and means for creating a blast of air through said nozzles and for regulating its volume and intensity. —T. W.

Art of and Device for Picking Cotton. Frederick W. Stukenborg, Chicago, Ill. .U.S.P.1,402,724, Jan. 3, 1922. Appl. 27/12/20. (14 claims: 4, 8 and 12 printed.)

Relates to picking seed cotton by rotary brush means, the brush drawing the cotton rearwardly and at a sufficient peripheral speed to doff the seed cotton from the brush by momentum of the seed cotton derived from the action of centrifugal force on the seed cotton mass, means to induce a rearward flow of conveying air from the brush means, and means to control said releasing force to release the cotton from the brush means to direct it in said conveying air. —T. W.

Treating Flax, Hemp, etc. F. G. Foster, Selby, Yorkshire. (I. J. Mahy, Ghent, Belgium.) E.P.173,591, Dec. 30, 1921. (Appl. No. 27,777/20.)

The stems are retted and the epidermis rendered gelatinous or viscous; the material is then subjected to strong compression between pressure rollers. The duration of the drying operation is shortened and the subsequent breaking (crimping) and scutching is simplified, or, owing to the action of the squeezing rollers, may be omitted. Scutching can be effected with the production of a minimum of dust. —T. W.

Removing Seeds from Flax, etc. T. E. Mitchell, Blairgowrie, and W. Dixon, Glasgow. E.P.173,132, Dec. 29, 1921. (Appl. No. 31,445/20.)

In apparatus where a pair of rollers are employed with intermeshing pins, the pins are arranged either singly or in groups in helices of opposite hand, or in a series of helices either side by side, or successively, or both. The pins are inclined with their points in advance of their bases, and are of a diameter between 0·05 and 0·07 of their length, and have a circumferential pitch between 0·45 and 0·6 of their length, and a longitudinal distance apart between 0·12 and 0·18 of their length. The apex of the series of pins of one roller is arranged to come midway between the apex and the base of the series on the co-acting roller. —T. W.

Hand Cotton Picking Apparatus. Abraham T. Shipman, Honey Grove, Tex. U.S.P. 1,402,670, Jan. 3, 1922. Appl. 11/10/20. (2 claims: 1 printed.)

Comprises a sack, a picker casing thereon, a picker chain or belt, and spring actuating means, said means being constructed and connected to be put under tension by movement of the sack and picker casing with respect to the body of the person by whom the apparatus is carried. —T. W.

Cotton Picker's Sack. Joseph William Watkins, Ridgeley, Tex., Assr. to John Lawrence Vick and others. U.S.P. 1,402,697, Jan. 3, 1922. Appl. 22/10/20. (1 claim: 1 printed.)

Comprises two separate members, the upper member being in the form of a tube of light fabric and the lower member being in the form of a bag of heavy fabric open at the top and closed at the bottom, with hooks and eyes for detachably connecting the lower member to the upper.—T. W.

Tramper for Cotton Presses. Nelson B. Henry, Atlanta, Ga., Assr. to The Murray Co., Tex. U.S.P.1,402,357, Jan. 3, 1922. Appl. 9/7/20. (5 claims: 1 printed.)

Comprises a frame, an endless chain mounted for revolution in said frame, means continuously to revolve said chain, a plunger mounted in the frame, means carried by the chain and plunger to connect the parts to lift the plunger, a stop upon the frame to disconnect the chain and plunger at a pre-determined point, connecting means carried by the chain and plunger, spaced from the first connecting means to connect the parts to lower the plunger, after a pre-determined idle travel of the chain. —T. W.

2.—CONVERSION OF FIBRES INTO FINISHED YARNS.

(A)—PREPARATORY PROCESSES.

Chinese Reelers and United States. Women's Wear, N.Y., 1922, **24**, 6.

Antung wild silk is not popular in America because the reelers will not use the Grant reel, and do not tie the ends of broken threads. Also silk of second quality is sold for first. —F. G. P.

(B)—SPINNING AND DOUBLING.

Doubler Twister; A New——. Amer. Silk Jl., 1922, **41**, 76.

Doubling and twisting are performed at one operation, the machine having a positive and very rapid stopping gear. The feed rolls are arranged to deliver silk uniformly on the spindles, with which they are synchronised. The spindles are widely spaced to prevent entangling of broken threads. The brackets of the traverse rails for the builder rings are separately mounted for each spindle, admitting of individual adjustment. —F. G. P.

High Drafting Systems. F. Krynes. Mitt. Forschungsinst. Text. Ind. Vienna, 1920, **1**, Feb., 83-91.

The Casablanca system is condemned, chiefly on account of the extra cost of overlooking the machines and the untrustworthiness of the leather bands. The Jannink system and the author's own appliance (Austrian Pat., 66,010/1914) are fully described. It is claimed that two of the latter machines, with four operatives and a consumption of about 12 h.p., will produce as much yarn as eleven or twelve of the usual machines (drawing, fly and ring frames), with fourteen operatives and about 20 h.p. The acknowledged drawbacks are (*a*) difficulty of lubrication; (*b*) necessity for the most exact mounting of the drawing mechanism. For these reasons, it is recommended that only the coarse and intermediate frames should be replaced by the new machine. —J. C. W.

Recent Developments in Textile Drives. See Section 7C.

(C)—SUBSEQUENT PROCESSES.

Improved Silk Throwing. Textiles, 1922, **20**, 23.

A machine is described and illustrated which is claimed to produce more uniform work. The number of twists per inch in a crêpe thread wound on the ordinary machine decreases as the bobbin grows and a second spinning is often needed. With the improved machine raw silk ends, for any ply are spun and twisted together in one operation. The spindle can be driven at 11,500 r.p.m., while twist may be up to 75 per in. —F. G. P.

(D)—YARNS AND CORDS.

Permanent Silky Feel on Yarns, Hose, or Gloves made from Cotton, Artificial Silk, Linen, Jute and Ramie. See Section 4K.

PATENTS.

Roving Stop-motion for Spinning Frames. George K. Kapatas, Providence, R.I., Assr. to J. E. Mulholland. U.S.P. 1,401,984, Jan. 3, 1922. Appl. 29/4/21. (2 claims: 1 printed.)

In a spinning frame, a round bar forms an original part of the drawing rolls standard, a roving stop-motion comprises a pivot support secured to the frame of the machine, a light horizontol rod pivotally secured to the support has a forward end engaging the roving in front of the drawing rolls, a vertical rod is pivotally secured to the rear end of the horizontal rod and having a curved clamping member shaped to fit over the round bar back of the drawing rolls, and over the roving and adapted to clamp the roving between the curved clamping member and the bar on the drawing rolls standard. —T. W.

Skein Winding Mechanism, etc. M. O. Clauss, New York, Assr. to Clark Thread Co. U.S.P.1,401,515—1,401,522, Dec. 27, 1921.

Relate to a method of winding skeins, a skein winding mechanism, skeining machine, skein holder, skein binding mechanism, article collecting and bundling mechanism, skein, skein supporting and folding means respectively. —T. W.

Cop Winding Attachment for Spinning Frames. Keith Stewart, Calcutta. U.S.P.1,400,009, Dec. 13, 1921. Appl. 21/6/20. (4 claims: 1 printed.)

Is characterised by a rotating thread twisting and cop building cone upon a sleeve within which is the ordinary spindle, driving means for the sleeve including a loose pulley, and a vertically sliding clutch adapted to be brought into and held in operative engagement one with the other, and engaging and disengaging means for pulley and clutch. —T. W.

Frame for Doubling Yarns. Fletcher Chadwick, Rochdale, England. U.S.P. 1,400,026, Dec. 13, 1921. Appl. 9/11/20. (2 claims: 1 printed.)

Comprises a warper's beam doubling frame, a plurality of spindles, drawing rollers parallel to the beam, means for drawing off groups of threads vertically in tape form, and means for distributing said groups diagonally to the drawing rollers and thence to the spindles over the wider distance occupied by the spindles while maintaining the groups in tape form. —T. W.

Combing Machine. John William Nasmith, Stockport, England. U.S.P.1,401,179, Dec. 27, 1921. Appl. 17/5/16. (12 claims: 1 printed.)

Comprises a combing cylinder, a detaching roller, a nipper pivoted above the cylinder in such a position that its point moves on an arc that lies closely adjacent to the peripheries of the cylinder and of the detaching roller, and a top comb pivoted approximately on the same centre as the nipper. —T. W.

Combing Machine. J. W. Nasmith, England. U.S.P.1,402,369, Appl. 3/8/16 (4 claims: 1 printed) and 1,402,370, Appl. 3/3/21 (3 claims: 1 printed), both of Jan. 3, 1922.

As an improvement, a pawl is provided with rack teeth, means given for movably supporting the pawl, a feed roll movable relative to the pawl, a ratchet wheel attached to the feed roll and engaging the rack teeth, and means for limiting movement of the pawl. Other improvements consist of a lap guide comprising spaced apart side plates, and a plurality of supporting members interposed between said plates and spaced apart longitudinally of the side plates to support successively the rearmost end of the lap in its travel. —T. W.

Fibre-conditioning Process and Apparatus. Albert W. Thompson, Lowell, Mass., Assr. to Parks-Cramer Co., Boston. U.S.P.1,401,376, Dec. 27, 1921. Appl. 14/11/17. (8 claims: 4 printed.)

A process of moistening fibres consists in forcibly projecting globules of a moistening liquid into a moving mass of textile fibres by means of a whirling jet of gaseous fluid. —T. W.

Spindle. John B. Nainteau, North Smithfield, R.I. U.S.P.1,401,485, Dec. 27, 1921. Appl. 17/1/20. (3 claims: 1 printed.)

The apparatus has, in combination, a spindle blade, a bolster receiving the spindle blade and in which the spindle blade is longitudinally and rotatably movable, a sleeve receiving the bolster and a cap for the lower end of the sleeve adjustably connected therewith and having a bearing for the lower end of the spindle blade, the cap being adjustable with respect to the sleeve longitudinally of it and the spindle blade being adjustable with the cap. —T. W.

Cap Spinning Frame. Joseph H. Jones, Winthrop, Mass., Assr. to Robert Burgess, Newton Center. U.S.P. 1,401,705, Dec. 27, 1921. Appl. 27/12/20. (19 claims: 1 printed.)

The frame has, in combination, a rotating spinning element, a cap surrounding said element and rotating in unison therewith. —T. W.

Ring Spinning or Twisting Machine. James C. Potter, Pawtucket, R.I. U.S.P.1,401,729, Dec. 27, 1921. Appl. 1/9/21. (13 claims: 2 printed.)

Comprises rings and travellers supported thereon, a stationary support for rings, thread feeding means situated a fixed distance from the rings, a carriage that supports spindles and spindle rotating means, and a builder motion for traversing said carriage and causing the movement of spindles and bobbins supported thereby to and fro through the rings, the travellers deriving their motion only from the pull of the threads as the latter are wound upon the bobbins. —T. W.

Thread Guide for Spinning Machines. Edward Rittenhouse, Philadelphia, Pa. U.S.P.1,402,538, Jan. 3, 1922. Appl. 10/8/18. (5 claims: 2 printed.)

Comprises a rotating spinning box for receiving the finished thread, a co-operative guide having capacity for automatic self centralisation within the spinning box under constant angular pull induced by gyration of the thread during its spinning. —T. W.

Stripping Waste from Bobbins. E. A. Terrell, North Carolina, U.S.A. E.P. 173,203. (Appl. No. 15,121/21.) Conv. Dec. 18, 1920.

A machine for removing waste yarns from bobbins. —T. W.

Spinning. F. W. Gostick, Scunthorpe, Lincolnshire. E.P.173,017, Dec. 29, 1921. (Appl. No. 24,517/20.)

Ring spinning, doubling, twisting and like machines are driven, say, from an electro-motor 9 through variable speed gearing 10, 11 comprising one or a pair of expanding pulleys of the type shown in Figs. 2, 3 and 4. Tread segments 1 are held between discs 2, 3, the former having radial guide-grooves 4, the latter having a spiral groove 6. The speed is varied by turning the disc 3 relatively to the disc 2. —T. W.

FIG.3.

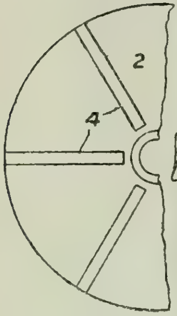


FIG.2

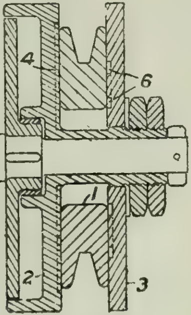


FIG.5.

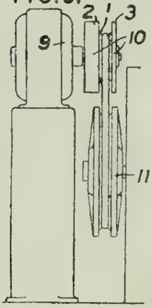
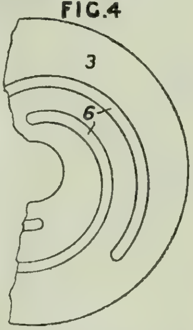


FIG.4



Machinery Guards. J. M. Hawksley, Heywood, and A. Hawksley, Rochdale. E.P.173,366, Jan. 5, 1922. (Appl. No. 29,484/20.)

A guard for lap rollers of openers, scutchers, etc., has a curved plate suitably pivoted and supported by studs which project into inclined slots in cranked brackets fixed to the rack heads. The rack heads and the curved plate are raised together as the diameter of the lap increases, so that the plate also forms a guard for the hands of the operator. —T. W.

Balling Twine, Thread, etc. E. N. Baines and J. W. Schmidt, Manchester. E.P. 172,782, Dec. 22, 1921. (Appl. No. 27,947/20.)

An expanding cap for the spindles of machines for this purpose comprises two pairs of arms pivoted to two collars fixed on the spindle, the ends of the arms being connected by two links which are jointed to a sliding collar on the spindle by another pair of arms. —T. W.

Combing Machine. James William Clegg, Oldham, England. U.S.P.1,402,569, Jan. 3, 1922. Appl. 12/2/20. (2 claims: 2 printed.)

Comprises a frame, a cylinder mounted for rotation in the frame, a bracket secured to the frame adjacent to the end of the cylinder, a cylinder cover provided with a pair of slotted projections, a bolt carried by each of said brackets and adapted to engage the slot of one of said projections for adjustably securing said cover to said brackets, and selvage guides adjustably connected to said brackets. —T. W.

Preparing Fibres for Spinning: Scutchers; Drawing Frames. F. Chadwick and J. Chadwick, Rochdale. E.P.173,122, Dec. 29, 1921. (Appl. No. 29,873/20.)

A scutcher for cotton is divided by separators into a series of narrower laps and the cotton is passed direct to drawing rollers without treatment in a carding engine. The usual calender rollers are omitted from the scutcher and the lap is passed from cages by delivery rollers to the drawing frame. The lap is divided before passing the detector rollers, and the narrower laps are formed into slivers and coiled in cans, or else delivered to holders. —T. W.

Spools. R. S. Bolger, New York, U.S.A. E.P.174,412, Jan. 5, 1922. (Appl. No. 33,639/20.)

Flanged spools, cops, bobbins, etc., are formed by winding sheet material such as paper or cardboard, which may be cut into blanks, coated with adhesive and then wound, or wound into cylinders and then cut, ground, and sawn into shape, so that the several parts will be integral.—T. W.

Drawing Fibres: Rollers. A. Johnman and Hawkins and Tipson, Ltd., both of London. E.P.173,433, Jan. 5, 1922. (Appl. No. 36,597/20.)

Wooden, metal, or leather pressing rollers are provided with bands of rubber or similar material. The bands are of sufficiently elastic nature to allow them to be sprung upon the rollers and to grip the surface so that they are not displaced in normal working, and through being drawn taut around the rollers, are of sufficient hardness not to spread under the pressure of the fluted drawing roller. The pressing roller comprises strips of leather held between metal end plates. —T. W.

Spinning: Spindle Apparatus. L. W. Campbell, Providence, Rhode Island, U.S.A. E.P.173,232. Appl. No. 34,292/21.) Conv. Dec. 21, 1920.

Flyers for roving frames and like apparatus comprise a socket provided with sleeves depending from an arm, and a leg, which carries the presser, pivoted in ball bearings in the sleeve and connected by a cord with a weight in the sleeve. The socket is connected to a reduced part of the spindle by a pin and slot connection. —T. W.

Curling Yarns. H. F. Sykes and J. Pickering, both of Almondbury, Huddersfield. E.P.173,392, Jan. 5, 1922. (Appl. No. 31,484/20.)

A machine for curling or twisting wool or mohair yarns comprises a rotary hollow tube through which yarn from a drum passes, being fed by a roller which carries a worm wheel in gear with a fixed worm. The yarn is fed positively according to the speed of rotation of the tube. —T. W.

Bobbins. J. Forshaw, Bootle, Liverpool. E.P.173,429, Jan. 5, 1922. (Appl. No. 36,314/20.)

Wooden bobbins for use in the textile trades consist of a central barrel with its ends shouldered down slightly and end discs or flanges, the apertures in which are countersunk, which countersink may extend the whole depth of the flange. —T. W.

Carding Kapok. P. Gobinet. F.P.516,817. Appl. 27/10/19.

A machine for ginning and carding kapok comprises a ginner with movable beater and fixed counter-beater, a sieve, two cards with movable and fixed pins, a screw-shaped conduit for each card. The machine has the advantage of possessing two cards, and can also be transformed into a single card. —Bur. Text.

Spinning Fine Viscose Silk; Bath for——. E. Bronnert. F.P.515,491. See This *Jl.* (Abs.), 1922, **13**, 56.

3.—CONVERSION OF YARNS INTO FABRICS.

(C)—WEAVING.

Loom; A Perfected High Speed——. Amer. Silk Jl., 1922, **41**, 73.

Describes a loom in use in Paterson and claims no floats, shires, filling breaks or cockles, drawn edges, weight marks, or damaged warp. The shuttle does not touch the reed or the silk, and the work is always in view. A weaver can operate four looms working 200 picks a minute. The loom for a 52in. cloth measures 2ft. 6in. by 8ft. 4in. —F. G. P.

Looms; The New Oerliken Geared Individual Drive for——. See Section 7C.

(D)—KNITTING.

Permanent Silky Feel on Yarns, Hose, or Gloves made from Cotton, Artificial Silk, Linen, Jute and Ramie. See Section 4K.

Cotton Hose Dyeing. See Section 4I.

(E)—LACEMAKING AND EMBROIDERING.

Electricity in the Lace Industry. See Section 7C.

PATENTS.

Weft Stop Motion for Looms. Harvey O. Brown, Easton, Pa. U.S.P.1,398,713, Nov. 29, 1921. Appl. 24/8/20. (7 claims: 1 printed.)

Automatic loom stopping mechanism comprises a lay, feeler fingers adapted resiliently to bear against a filler as the lay beats up, a dagger carried by the lay and adapted to be elevated under the control of said feeler fingers when the fingers are released by the breaking of said filler; a breast beam, a knock-off lever attached to the upper face of the breast beam and having connections whereby it is adapted to control the clutch of the loom, the knock-off lever being so positioned as to be interposed in the path of the dagger when the same is elevated and to clear it when the said feeler fingers are bearing on a filler; a shield lifter forwardly projecting from the lay and an inclined shield pivotally attached to said knock-off mechanism and adapted to receive the thrust of said dagger, said shield having a cam adapted to be engaged by the said shield lifter and to cause the shield to be raised as the lay beats up. —T. W.

Knitting Instrument. J. Frank Wilcomb, Worcester, Mass., Assr. to Spartan Needle Co. U.S.P.1,398,821, Nov. 29, 1921. Appl. 10/4/20. (10 claims: 1 printed.)

A loop forming instrument comprises two relatively slidable elements, one having a spring beard hook for seizing the new yarn and the other including means for penetrating the old loop at the back of the first-mentioned element and progressively engaging the sides of said loop towards the front of the needle to spread said old loop for the reception of the extremity of said beard within the range of said spread loop. —T. W.

Arm for Knitting Machine. Edward H. Stines and Wilbur C. Potter, New Brunswick, N.J. U.S.P.1,399,278, Dec. 6, 1921. Appl. 19/2/19. (4 claims: 1 printed.)

With a support for thread controlled stop mechanism is combined an arm having one end to be secured to the support and having its opposite end bent to extend laterally, then longitudinally, then transversely, and then reversely, to enable a thread guide to be secured to the arm at the points where the arm is bent longitudinally and reversely. —T. W.

Weaving Heald and Process for Manufacturing. Alphons Zipfel, Lachen, Switzerland. U.S.P.1,399,237, Dec. 6, 1921. Appl. 31/3/21. (6 claims: 1 printed.)

The loom heald comprises a heald shaft of double steel wires, the ends of which are bent away from one another and ears at either end of the heald shaft formed of small steel plates and provided with corresponding slots in which said ends of the wires are arranged and connected to the plates by soldering. —T. W.

Take-up Mechanism for Knitting Machines. Kenneth Howie, Philadelphia, Pa., Assr. to Wildman Mfg. Co. U.S.P.1,399,121, Dec. 6, 1921. Appl. 3/3/19. (5 claims: 1 printed.)
Combined with the take-up for knitting machines are two take-up rolls, a movable support therefor, driving means for the take-up rolls, including a clutch, a connection from the movable take-up support for controlling the clutch and adjustable gravitating means for exerting pressure to vary the driving action of the clutch according to the demands of the work.
—T. W.

Knitting Machine Construction. Walter Larkin, Philadelphia, Pa., Assr. to Fidelity Machine and Mfg. Co., Philadelphia. U.S.P.1,398,865, Nov. 29, 1921. Appl. 1/7/19. (5 claims: 1 printed.)
A circular machine has, in combination, a main supporting frame, a needle cylinder, an adapter ring removably connecting the frame and the cylinder, and a cam ring rotatably mounted on the adapter ring.
—T. W.

Knitting Needle. Sydney E. Taft, Framingham, Mass., Assr. to Spartan Needle Co. U.S.P.1,398,813, Nov. 29, 1921. Appl. 10/1/20. (24 claims: 16 printed.)
The needle comprises a hook and means slidably arranged at one side only to effect the opening of the loop supported by said hook for the passage therethrough of said hook and the casting off of said loop from said hook. —T. W.

Harness for Looms or the Like. Edgar F. Hathaway, Boston, Mass. U.S.P. 1,399,298, Dec. 6, 1921. Appl. 4/11/15. (1 claim: 1 printed.)
A heddle cord for holding the heddle eye of a heald embraces a cord looped through the eye and doubled back upon itself to form a closely assembled double strand, a fastening clip comprising a single piece of flexible sheet material wrapped completely around the double strand under sufficient pressure to embed the whole clip in the encircled portion of the double strand so as to afford no projection beyond the outer surface of the adjacent portions of the double strand, the free ends of said clip being laterally offset when so embedded to pass beyond each other circumferentially of the double strand, thereby avoiding the overlapping of one end of the clip above the other. —T. W.

Braiding Machines. E. Gerber, Brugg, Switzerland, Assee. of Seeberger and Co., O. E.P.172,019. (Appl. No. 31,391/21.) Conv. Nov. 23, 1920.
Machines for making lace by braiding are provided with intermittingly rotated bobbin-driving discs which are connected to or disconnected from continuously rotating gear wheels by the action of the pattern-forming apparatus. The pattern-forming apparatus is adapted to raise or lower rods into or out of engagement with lugs on the underside of the bobbin-driving discs. —T. W.

Weaving Machine. Thomas Terrell, London, England. U.S.P.1,399,904, Dec. 13, 1921. Appl. 24/2/20. (17 claims: 17 printed.)
A mandrel for circular looms comprising a body portion having part of its surface provided with a spiral shoulder, the angle of which is substantially equal to the angle of the spiral on which the weft threads are laid. —T. W.

Knitting Mechanism: Instrument therefor, and Method of Knitting. William A. Houck, Reading, Pa., Assr. to Hemphill Co. U.S.P.1,400,163, Dec. 13, 1921. Appl. 12/8/19. (35 claims: 7 printed.)
Comprises in combination a series of needles and a series of sinkers, including interspersed special sinkers or instrumentalities, and operating means to cause the special sinkers or instrumentalities to measure off or take additional yarn and thereafter to prevent robbing, thereby securing the permanent apportionment of such additional yarn. —T. W.

Yarn Severing and Clamping Device for Knitting Machines. Albert M. Pigeon, Norristown, Pa., Assr. to Wildman Co. U.S.P.1,400,180, Dec. 13, 1921. Appl 21/9/16. (13 claims: 1 printed.)
The device includes a needle cylinder, needles carried thereby, yarn guides, a relatively fixed shearing blade, a movable shearing blade, a spring for actuating last-named blade for its shearing action, an oscillating cam and devices co-operating with cam to shift and set the movable shearing blade against the tension of the spring, to hold said blade in its set position, and to trip said blade, all during movement of said oscillatory cam one way.
—T. W.

Loom. Edward David Roy, Greenville, S.C. U.S.P.1,400,318, Dec. 13, 1921. Appl. 25/3/18. (2 claims: 1 printed.)
The loom has in combination a sword having a bearing formed thereon close below the lay beam and adapted to support one side of the protector rock-shaft, an adjustable oil-impregnated bearing block for the other side of said protector rock-shaft, the same being detachably secured to the sword opposite to the bearing therein. —T. W.

Loom for Weaving Axminster Carpets and Rugs. Charles H. Collins, West Albany, N.Y., Assr. to S. Sanford and Sons. U.S.P.1,400,941, Dec. 20, 1921. Appl. 15/2/21. (10 claims: 1 printed.)
Comprises the usual weaving mechanism, a positive tuft-yarn feeding device driven therefrom and adapted to feed a fixed predetermined amount of tuft yarn during each cycle of the weaving mechanism, said device comprising two pairs of coacting rolls joined by an operative connection, and reeds, one mounted in the rear of each of said pairs. —T. W.

Yarn Package and the Like and Method and Mechanism for Winding It. Thomas Andrew, Rochdale, England. U.S.P.1,400,403, Dec. 13, 1921. Appl. 14/4/20. (10 claims: 1 printed.)

Securely fixed over-lapping coils of yarn are wound on the holders previously to the ordinary initial windings of the yarn packages and on parts of the holders to protect from the first wound ends of completed yarn packages. —T. W.

Pile Fabric Frame. Percival W. Copeland, Clark Mills, N.Y., Assr. to Hind and Harrison Plush Mills. U.S.P. 1,400,529, Dec. 13, 1921. Appl. 7/5/18. (5 claims: 1 printed.)

A frame for storing and transporting pile fabric. —T. W.

Selvage Trimmer for Looms. Harry T. Abbott, Landing, N.J., Assr. to Draper Cor. U.S.P.1,400,711, Dec. 20, 1921. Appl. 7/12/20. (13 claims: 1 printed.)

A cutting mechanism, supported from the frame with its field of action beneath the selvage of the cloth and forward of the fell, operates in a plane at an angle to the vertical and is operated from a moving part of the loom whereby weft ends depending from the selvage are severed. —T. W.

Preparation of Knitted Fabrics for Use. Charles E. Shaw, East Weymouth, Mass. U.S.P.1,401,501, Dec. 13, 1921. Appl. 3/5/19. (9 claims: 4 printed.)

Tubular knitted fabrics for handling are prepared by reinforcing a longitudinal zone thereof by means positioning the threads in the zone against relative movement and longitudinally slitting the fabric along said zone. —T. W.

Circular Glove Knitting Machine. John Lawson, Central Falls, R.I., Assr. to Hemphill Co. U.S.P.1,401,712, Dec. 27, 1921. Appl. 12/12/18. (28 claims: 1 printed.)

Relates to means to knit the hand and fingers of a glove, and picker means to fashion the tips of the fingers during and by the knitting operation. —T. W.

Embroidering Attachment for Flat Knitting Machines. Karl Friedrich Nebel, Philadelphia, Pa., Assr. to Noldt and Horst Co. U.S.P.1,401,720, Dec. 27, 1921. Appl. 23/11/20. (9 claims: 9 printed.)

The mechanism includes knitting needles for forming fabric of body yarn, means including guides for feeding other yarn to the knitting needles to form contrasting effects upon the ground fabric made from the body yarn, means for raising vertically, and substantially in unison, the needles and guides, and means for moving the guides transversely of the machine in register with needle spaces while the lower parts of the guides are in substantially the same horizontal plane as the upper parts of the needles. —T. W.

Warping and Beaming Machine. Grant Sipp, Paterson, N.J. U.S.P.1,401,655, Dec. 27, 1921. Appl. 9/4/17. (5 claims: 1 printed.)

Comprises a rotary member whose rotation is to be resisted, a supporting structure and mechanism therein to resist rotation of said member. —T. W.

Thread Carrier Stop Mechanism for Full-fashioned Knitting Machines. Melchoir Zwicky, Wyomissing, Pa., Assr. to Textile Machine Works. U.S.P. 1,402,033, Jan. 3, 1922. Appl. 20/1/20. (2 claims: 1 printed.)

Comprises thread carrier rods and a narrowing screw, a stop nut on said screw carrying a plurality of selectively usable stops for one rod each arranged to be moved into and out of end-abutting position. —T. W.

Knitting Machine. George L. Ballard, Norristown, Pa., Assr. to Wildman Co. U.S.P.1,402,038, Jan. 3, 1922. Appl. 10/5/20. (9 claims: 1 printed.)

A machine with spring beard needles has a cylinder, a ring having a ledge and a rib overhanging the same and pressers individual to the needles pivotally supported at their lower ends on the ledge. —T. W.

Tucking and Drop-stitch Mechanism for Knitting Machine. Frank W. Robinson, Reading, Pa., Assr. to Nolde and Horst Co. U.S.P.1,402,379, Jan. 3, 1922. Appl. 21/5/19. (5 claims: 1 printed.)

Provides for needles having butts of different lengths and certain of the long and short butt needles provided with relatively long latches, main latch clearing cams adjustable to clear all of the needles or the short-latch needles only, and supplemental latch clearing cams effectively operative upon the shorter-butt needles only. —T. W.

Knitting Neck-Ties. Redfern, Rhead and Co., Ltd., Congleton, and J. W. Rowley, Macclesfield. E.P.172,847, Dec. 22, 1921. (Appl. No. 31,507/20.)

Horizontally striped tubular seamless fabric is knitted in one continuous automatic operation, and the neck-band is shaped by reducing the number of threads in knitting, the omitted threads floating on the inside of the tube. —T. W.

Looms: Brakes, etc. J. Scott and Sons, Ltd., and A. Mudie, of Dundee. E.P. 172,870, Dec. 22, 1921. (Appl. No. 36,143/20.)

In drags for loom beams of the type having adjustable shoes engageable with the beam or with an element connected therewith, two series of friction shoes are provided with friction linings, say, of leather, one arranged on each side of a convex surface on the drag shaft so that there is no tendency for the drag to move axially of the drag shaft. —T. W.

Splicing Mechanism for Circular Knitting Machines. George F. Bosworth, Central Falls, and Eugene M. Gunning, Pawtucket, R.I., Assrs. to Hemphill Co. U.S.P.1,402,394, Jan. 3, 1922. Appl. 4/6/14. (5 claims: 2 printed.)
The machine has, in combination, a main yarn feed finger, means for splicing an area less than the full circumference of the stocking comprising a circle of needles, one-half of which are long butts instep needles and the other half of which are short butt heel and toe needles, a splicing yarn finger movable to and from feeding position, needle cams, and a central guard cam, the movable splicing yarn finger remaining in feeding position during round knitting and throughout the needle circle while the spliced area is being formed and thereafter being withdrawn. —T. W.

Looms. P. H. B. Chevalier, Paris. E.P. 172,638. (Appl. No. 32,877/21.) Conv. Dec. 13, 1920.
A device to give off warp when the shed is opening consists of a fixed back rest and two oscillating back rests, the latter being supported at the ends of levers which are oscillated by means of eccentrics on the crank shaft and connecting rods.—T. W.

Guard for Looms. C. Statter, C. Statter and H. Statter, of Darwen. E.P.172,515, Dec. 15, 1921. (Appl. No. 33,530/20.)
The sheet metal guide for duck-bill motion of loose-reed looms is secured by tongues to the heater, and has top and bottom flanges of a greater depth than the heater. The guard is cut out to suit the bracket and has a tongue to engage the bracket. A modified form is mentioned. —T. W.

Jacquards. J. Johnson, Hodgkinson and Pearson, Ltd., and P. Taylor, of Manchester. E.P.173,078, Dec. 28, 1921. (Appl. No. 27,415/20.)
The upper catch of jacquard cylinders is raised, or the lower catch depressed, out of the path of the receding cylinder by means of pins on a disc operated by an extra catch. In this way each jacquard card may be presented two or more times to the needles according as desired by the arrangement of the pins on the disc. —T. W.

Woven Fabrics: Ground Weaves. D. Aruga, San Francisco, U.S.A. E.P. 173,101, Dec. 29, 1921. (Appl. No. 28,721/20.)
Shoe insoles are woven with a ground weave consisting of warp threads arranged in groups, one set passing over, say, six weft threads and under two, while alternate groups pass similarly over six and under two wefts, these latter two being the central pair of the six passed over by the other groups. A binding warp passes under and over alternate wefts one each side of the above two warp groups. Certain of the wefts may pass at the back under all the warps (?). Spec. 30,655/97 is referred to. —T. W.

Lace Machines. H. Hadfield, Manchester. E.P.173,421, Jan. 5, 1922. (Appl. No. 35,115/20.)
Recesses or perforations are provided in the curved lower part of a lace machine carriage for the purpose of retaining powdered or other lubricants. —T. W.

Braiding Machines. J. Fentress, Chicago, U.S.A. E.P.173,428, Jan. 5, 1922. (Appl. No. 36,041/20.)
The shuttles of the machines are mounted in recesses in a passage of a rotary table supported on two arms, and are carried by means of springs projecting from the side walls of the recesses into slots extending along the sides of the shuttles. Two other springs mounted on each shuttle bear lightly at their ends against the side walls of the recesses. —T. W.

Automatic Loom. Ter Kuile. F.P.516,698. Appl. 4/6/20.
This loom is provided with two or more changing boxes, an electric detector, and one or more cop storers each having two groups of cops. An expelling motion for empty cops is moved by an electro-magnet excited by the current passing through the detector. This acts upon a disposal of blocking fixed to a movable rod in relation with the motion of cop-storers and of the beating of slay. A rotary disc with an adjustable friction plate points out the exact moment where the electric current will excite the electro-magnet after the changing of the cop-storer. —Bur. Text.

4.—CHEMICAL AND OTHER PROCESSES.

(B)—SCOURING AND DEGUMMING

Soaps in the Silk Industry. G. C. Friend. Amer. Silk Jl., 1922, **41**, 71.
Deals with the necessity of carefully choosing soap for use with silks; pure olive oil or red oil soaps are recommended. —F. G. P.

Scouring and Milling. See This *Jl.* (Proc.), 1922, **13**, 43.

Textile Fibre: Adsorption. See Section 6.

(D)—MILLING.

Scouring and Milling. See This *Jl.* (Proc.), 1922, **13**, 43.

(G)—BLEACHING.

Bleaching of Cotton and Flax. B. de Puyster. Rev. mens. du Blanchissage, 1921, **16**, 45-47.
Short notes are given under the following headings:—Loss of weight on bleaching; influence of bleaching on the length of cotton thread; influence of the method of bleaching on the strength of flax thread; influence of humidity of the fibre in bleaching tests on cotton and flax; absorbent quality of bleached cotton; distinction between bleached and unbleached cotton. —J. C. W.

The Influence of the Temperature of the Bleach Liquor in Prolonged Chlorine Bleaching on the Stability of Cotton. P. Heermann and H. Frederking. Textilberichte, 1922, 3, 61.

It is pointed out that the influence of temperature is greater than practical men are inclined to accept. Using the same conditions as in previous experiments (see This *Jl.* Abs., 1922, **13**, 15), *i.e.,* 75 min., chlorine content 0·5 grams per 1,000, the following results were obtained at 29°C. After 50 bleachings the strength fell from 33·1 kg. to 19·9 kg.; elasticity rose from 8·8% to a maximum of 9·5% and then fell to 8·4%; the sq. metre weight fell from 115 to 108. At 37°C. strength fell from 33·1 kg. to 13·0 kg.; elasticity from 8·8% to 7·2%, and weight from 115 to 101. Comparing the effect at different temperatures, 5, 10, 15 and 20 bleachings at 29°C. gave the same decrease in strength as 12, 24, 35 and 48 at 20°C. Further, 5, 10, 15, 27 bleachings at 37°C. had the same effect as 13, 25, 33, 40 and 50 at 29°C. By raising the temperature 9°C. in first case the reduction is 2·38 times, in the second for 8°C. 2·1 times, *i.e.*, the reduction in the stability is doubled by raising the temperature of bleach 7·5°C. It follows from the experiments that:—The attack on the fibre proceeds parallel to the decomposition of the liquor and speed of bleaching; cellulose attack follows the general rule that the rate of all chemical processes is doubled by raising the temperature 7·5°C.; the great influence of a proportionately small increase in the temperature of the liquor is of great practical importance.
—E. B. A.

The Determination of the "Bromine Figure" or "Chlorine Factor" of Pulp and the Utilisation of these Quantities in Bleaching. See Section 6.

(I)—Dyeing.

Boiled-off Liquor in the Dye Bath. G. Emmons. Silk, N.Y., 1922, **15**, 75.

Yellow Italian silk becomes white on degumming. When only half the gum is removed it is spoken of as souple silk. Free alkali in the soap solution tends to injure the fibre. High-grade hard olive soap is recommended, but not soft soaps. The boiled-off liquor is used for dyeing silk in either alkaline or with a little acetic acid. Direct and basic colours may be used in this way, as well as acid colours, which can stand up to 25% boiled-off liquor on the volume of the bath. Details are given for using a number of colours.
—F. G. P.

Vat Dyes on Wool. D. K. Colledge. Text. Merc., 1922, **66**, 145.

It is pointed out that a full range of shades cannot be obtained at present, owing to the lack of a suitable yellow. The excellent fastness of many of the dyestuffs should lead to their extensive adoption.—L. M. S.

Cotton Hose Dyeing. J. Schmidt. Textilberichte, 1922, **3**, 9-11.

A general account is given of the dyeing of black and coloured cotton hose and also of that made from mercerised yarn.
—J. C. W.

Colour Measurement and the Importance of Fluorescence and Polarization Phenomena in such Measurements. See Section 10.

Ostwald Colour Theory; Importance of the——in Dyeworks. II. See Section 10.

Photochemistry; Investigations on the Fundamental Law of——. See Section 6.

(K)-Finishing.

Moiréing Silk Fabrics. Posselt's Text. Jl., 1922, **30**, 1.

Moiré effects are produced either by an engraved roller or by repeatedly heavy-mangling two surfaces of cloth together. The latter method is more suitable for silk or half-silk taffetas. An expensive form is produced on the loom, either Jacquard or movable reeds. Undesired moiré effects are sometimes produced on tightly wound beams of heavy Jacquard cloth. It is possible to remove these by "papering" and keeping in a humid atmosphere for a week.
—F. G. P.

Permanent Silky Feel on Yarns, Hose, or Gloves made from Cotton, Artificial Silk, Linen, Jute and Ramie. Textilberichte, 1922, 3, 53.

Unbleached cotton yarn and hose are boiled for 2 hours in a 3% solution of caustic soda containing 2% of soft soap, centrifuged and dyed. Bright colours are dyed from a boiling, 3% soft soap bath, with or without the addition of Glauber salt and 2% of soda ash, according to sample. The goods are centrifuged, treated in the cold in a bath containing 2% of acetic acid and 2% of formic acid, and centrifuged and dried without washing. Finished black goods are washed and boiled in a bath containing 3% soft soap, 2% soda ash and 1% cocoanut oil, then treated with acetic and formic acids as above. Bleached goods do not require any previous treatment, but are dyed directly from the soap bath. Basic colours are dyed by the tannin-tartar emetic process in a soap bath at 50°C., centrifuged and treated with formic acid.
—J. C. W.

Crêpe Effects; Production of——. G. Heberlein. Rev. Gen. l'Ind. Textile, 1921, **6**, 47.

A fabric similar to crêpe, but fuller and softer, is obtained by treating bleached, mercerised cotton fabric with sulphuric acid of 49-50°B. The lustre due to mercerisation disappears, and the parchmenting obtained with a stronger acid is avoided at this concentration. The new fabric is similar to a light woollen material.
—J. C. W.

PATENTS.

Cloth-handling Device. Albert Rau, Clifton, N.J., Assr. to United Piece Dye Works, Inc. U.S.P.1,398,043, Nov. 22, 1921. Appl. 5/2/21. (14 claims: 1 printed.)

Relates to combination with means for drawing cloth upwards, of means for feeding water against the cloth near the top of its run so that it may flow downward along the upwardly moving cloth, fixed edges by which the cloth is guided so that it is diverted from a straight line in both directions, and fixed deflectors extending from the edge for bringing the downflowing water against the cloth from each side. —T. W.

Waterproofing Fabrics. W. A. Mitchell, Balbeuchley, Forfarshire. E.P.171,726, Nov. 21, 1921. (Appl. No. 16,783/20.)

Made-up fabrics in the form of sheets and strips, such as tarpaulins and wagon covers, are waterproofed by spraying with such velocity as to cause all cells or interstices of the fabric to be entered, the occluded air being free to escape before the bombardment of the sprayed particles and the excess waterproofing solution being free to run down the sheet, which is preferably dried before spraying.—T. W.

Waterproof Fibrous Material and Process of Making. George A. Richter, Wallace B. van Arsdel, and Donald H. White, Berlin, N.H., Assrs. to Brown Co. U.S.P.1,396,060, Nov. 8, 1921. Appl. 13/9/19. (10 claims: 2 and 9 printed.)

The process consists in distributing sulphur throughout the body of the fibrous material, and then impregnating the material with a water-repellent compound which is solid at ordinary temperatures. The article illustrated is a rigid waterproof paper tube throughout the pores and interstices of which is distributed free sulphur and a waterproofing compound comprising bitumen. —T. W.

Dyeing Machine. Howard M. Dudley, Philadelphia, Pa. U.S.P.1,397,860, Nov. 22, 1921. Appl. 21/11/19. (3 claims: 1 printed.)

A dyeing machine has, in combination, a closed receptacle, a dyeing chamber within the receptacle and spaced therefrom, the dyeing chamber having a foraminous top and a foraminous bottom, a propeller chamber connecting the upper and the lower chambers formed by the tops and bottoms of the receptacle and the dyeing chamber. A series of openings connect the side chambers formed by the sides of the dyeing chamber and the receptacle with the lower portion of the propeller chamber, and a series of openings connect the side chambers formed by the sides of the dyeing chamber and the receptacle with the upper portion of the propeller chamber. —T. W.

Dyeing. Calico Printers' Assocn., Ltd., Manchester, and F. O. Ashmore and F. Cochrane, New Mills, Derbyshire. E.P. 172,193, Dec. 8, 1921. (Appl. No. 30,140/20.)

Colour effects are produced on fabrics by crumpling or pressing them, by hand or mechanically, into a cylinder or vessel in which a number of small holes are provided at intervals. The filled vessel is moved up and down in a dye vat by means of a cranked shaft and a chain, so that the dye penetrates through the holes to the fabric, producing irregular markings thereon. Modifications are mentioned and an apparatus illustrated which comprises a rotary perforated cylinder in which the fabrics are located. Dyes are passed from a vat through the perforations of the cylinder. —T. W.

Treating Textile Goods, etc., with Liquids. E. W. Morgan, Philadelphia, U.S.A. E.P.172,238, Dec. 8, 1921. (Appl. No. 2,418/21.)

A barrel or similar vessel is provided with perforated partitions for showering dyeing or other liquid contained in the barrel on to textile goods, etc., retained between the partitions. The barrel is surrounded by a steam-jacket mounted between tubular trunnions supplying to and drawing off steam from the jacket, and is rotated intermittently and held stationary by mutilated gear wheels. In operation, the goods are inserted through a charging opening in the central chamber provided with supports, such as wire work, to prevent the goods from becoming matted together. The dye is passed through a pipe to the barrel, which is preferably filled to the level of its axis. If the dye is to be heated, steam is admitted through a pipe and valve. The mutilated gearing, by rotating the barrel half a turn at a time, brings the dye to the top segmental space whence some of it is sprayed through small perforations in the top partition to the goods in the central chamber, while the rest flows through larger and adjustable holes at the ends of the partition and through a passage to the bottom segmental space, where some of it rises through the bottom partition to immerse the lower portion of goods in the central chamber. The next half-turn of the barrel causes the dye to flow back in the reverse direction. A gauge glass and thermometer are provided on the barrel. —T. W.

Method of Coating Fabric with Vulcanisable Plastic Material. George F. Fisher, Providence, R.I., Assr. to Revere Rubber Co. U.S.P.1,402,288, Jan. 3, 1922. Appl. 9/9/20. (2 claims: 1 printed.)

A continuous method of skim-coating both sides of fabric with relatively stiff and non-spreadable plastic which consists in continuously forming the plastic into continuous and unbroken films of the desired uniform thickness and immediately feeding the films while free and unconfined to opposite sides of the fabric. —T. W.

Treating Textile and other Goods with Liquids. E. W. Morgan, Philadelphia, U.S.A. E.P.171,891, Dec. 1, 1921. (Appl. No. 31,928/20.)

A machine consists of a barrel or like vessel with two longitudinal perforated partitions between which the goods and the liquid are placed. The liquid accumulates in the outer compartment (the bottom section for the time being) as the barrel rotates so that the liquid runs down through the perforations and through the goods into the other outer compartment when the latter reaches the low position of rotation. The barrel is intermittently rotated by interrupted toothed gearing. The partitions consist of channel-section plates with small perforations or with larger gauze-covered perforations. They may be movable in guides so as to act as valves, and/or may be fitted with valves and guards to enable the liquid to run freely into the lowest outer compartment. —T. W.

Plaiting Machine. John Whyte, Chicago, Ill., Assr., by mesne assignments, to Service Cloth Pleating Co. U.S.P. 1,399,231, Dec. 6, 1921. Appl. 13/12/20. (10 claims: 1 printed.)

Comprises a table with steaming device at one end through which a strip of cloth is adapted to pass; pressing means, a pair of super-imposed endless elements, and means carried by said elements for plaiting cloth after it leaves the steaming and before it reaches the pressing. —T. W.

Cloth Cutting and Pattern Making Machine. Joseph A. and Harry Rosenfeld, Cleveland, Ohio. U.S.P.1,398,396, Nov. 29, 1921. Appl. 28/3/21. (6 claims: 1 printed.)

The machine has, in combination, a needle for making perforations to mark a design, means for reciprocating the needle, a reservoir for a marking fluid, a tube leading from the reservoir, and the tube having aligning openings in its wall for the passage of the needle. —T. W.

Fabric-Cutting Device. Anders Lassen Berthelsen, Chicago, Ill. U.S.P. 1,399,924, Dec. 13, 1921. Appl. 19/4/20. (10 claims: 1 printed.)

Comprises a blade holder, and means movable along the holder to change thereby the point of the blade edge which is operative to effect the cutting action, the severed portions of the material being guided laterally outward with respect to the blade edge. —T. W.

Embroidery Frame. William Koller, White Plain, N.Y. U.S.P.1,400,293, Dec. 13, 1921. Appl. 23/7/20. (11 claims: 1 and 11 printed.)

Relates to the employment of several frames adapted to have cloths mounted thereon and to means for positioning the cloths so that the same design may be embroidered on each by a machine. —T. W.

Dyeing Apparatus, etc. H. Bowden and T. W. Bowden, both of Littleborough. E.P.173,397, Jan. 5, 1921. (Appl. No. 32,509/20.)

The material is carried through liquid in a tank by means of two endless travelling flexible platforms or lattices guided in a zig-zag course, the platforms, etc., are each provided with inwardly-extending plates or projections at intervals, whereby the material may form folds or loops. T. W.

Machine for Mercerising Hose and other Knitted Fabrics. Alfred Ernest Hawley, Hinckley; Percy Field Crosland, Halifax; and Francis Graham Dixon, Cheadle Hulme, England. U.S.P. 1,400,159, Dec. 13, 1921. Appl. 5/1/20. (3 claims: 1 printed.)

The goods are mounted on stretching forms or plates and the forms passed between a series of pairs of rollers, each succeeding pair of rollers being driven at a greater peripheral speed than the preceding pair. —T. W.

Dyeing Machine. Fredrick Carter, St. Agathe des Monts, Quebec, Canada. U.S.P.1,400,417, Dec. 13, 1921. Appl. 23/2/21. (5 claims: 1 printed.)

Comprises a receptacle, a T-shaped member supported above and extending into the receptacle and guides positioned at each end of the T-shaped member whereby the material to be dyed may be guided through the receptacle. —T. W.

Machine for Treating Blankets. John McCreary and Edward J. McCreary, Cohoes, N.Y. U.S.P.1,400,446, Dec. 13, 1921. Appl. 17/7/20. (6 claims: 2 printed.)

A blanket napping machine comprises a brush cylinder and means for feeding thereto of an adjustable curved rigid pressure bar depending in advance of the cylinder and between the feed rolls and the cylinder. —T. W.

Feeding Mechanism for Hosiery Presses. Charles E. Waream, Cincinnati, Ohio, Assr. to American Laundry Co. U.S.P. 1,400,645, Dec. 20, 1921. Appl. 27/5/18. (10 claims: 1 printed.)

A pressing machine, a feeding table, means for advancing stockings step by step along said table, and means associated therewith for removing the stockings from the table and delivering them to the pressing machine. —T. W.

Process of Dyeing Yarns and the Like. James A. Grundy, Philadelphia, Pa., Assr. to John Bromley and Sons. U.S.P.1,400,675, Dec. 20, 1921. Appl. 11/8/21. (2 claims: 1 printed.)

The yarns are supported in a suitable container of dyeing liquor which has been previously heated to a temperature of approximately 212°F.; the dye liquor is then discharged into the region of the suspended yarns by means of compressed air. —T. W.

Process for Producing Wool-like Effects on Cotton Fabrics. Gustav Adolf Bosshard, Arbon, Switzerland. U.S.P.1,400,016, Dec. 13, 1921. Appl. 9/11/20. (3 claims: 1 printed.)

Fabrics are treated with nitro-sulphuric acid of 48·3° Bé, cooled down to at least 0°C. —T. W.

Cloth Finishing. Gustav Wolf, East Providence, R.I. U.S.P.1,401,663, Dec. 27, 1921. Appl. 2/8/21. (6 claims: 1 printed.)

The device consists of a lower roll having a felt covering, and an upper roll having metallic teeth of spiral form and arranged to be of alternating depths, to provide a three-point contact with the cloth.—T. W.

Fabric Stripping Machine. Cassell D. Hibbs, Fort Worth, Tex. U.S.P. 1,402,067, Jan. 3, 1922. Appl. 24/2/19. (7 claims: 1 printed.)

Comprises a reel adaptable for holding tyre casings of different diameters, a stripping shaft, means for positioning said shaft closer to or farther from said reel, and means for driving the shaft. —T. W.

Drying and Shaping Structure for Drying Lace Hosiery. Thomas F. O'Connell, Chicago, Ill., Assr. to Paramount Co. U.S.P.1,402,532, Jan. 3, 1922. Appl. 27/5/19. (9 claims: 1 printed.)

The form is relatively thin in cross section and has arc-shaped fabric-flattening front and rear faces, the width dimensions of which vary intermediate the ends of the form, and has, also, oppositely-disposed crease-producing side edges. —T. W.

Cloth Plaiting Machine. Henry E. Elrod, Dallas, Tex. U.S.P.1,402,584, Jan. 3, 1922. Appl. 23/2/21. (8 claims: 1 printed.)

The cloth is first folded by means of guide boards, supporting wires extending from one guide board to the other engaging the cloth along the lines of fold, and is then drawn through the machine and the folds of the cloth compressed. —T. W.

Stretching Webs. A. Livesey, Manchester. E.P.172,493, Dec. 15, 1921. (Appl. No. 30,842/20.)

A bar or roller for stretching fabrics or other webs in the width comprises one or more strips of rubber or other equivalent material wound round a base between the coils of one or more springs which act to hold the strips in place. —T. W.

Apparatus for Dyeing, Washing, etc. Simplex Patent Dyeing Machine Co., Ltd., Batley, and J. H. Hornsell, Ossett. E.P.173,405, Jan. 5, 1922. (Appl. No. 33,246/20.) Addition to 16,199/15.

Machines of the kind described in the parent specification are provided with an air injector adapted to cause air and steam or steam alone to be circulated through the apparatus according to whether the contents are required to be agitated or boiled. —T. W.

Rollers for Calendering, etc. P. Crosland, Bury. E.P.172,994, Dec. 16, 1921. (Appl. No. 16,250/20.)

A hollow cylinder for calenders has spiral leads without any core in its interior to divert heating liquid and so bring the liquid into intimate contact with the internal cylinder walls. Bearing portions are formed on the ends of the cylinder, and inlet and outlet pipes pass through sleeves which are out of contact with the inner faces of the bearing portions to prevent escape of heat to such bearing portions. Each sleeve has an enlarged end to act as a gland for pressing packing between itself and a loose gland placed at the entrance to the chamber. Stuffing boxes are provided at the ends of the bearing portions and kept tight by glands. —T. W.

Treating Fabrics, etc., with Liquids. L. Clarenbach, Passaic, New Jersey, U.S.A. E.P.173,167, Dec. 29, 1921. (Appl. No. 35,944/20.)

A machine for treating yarn or fabrics in open-width or rope-form comprises a number of vats each provided with two series of fabric-guiding rollers mounted on reciprocating bars which cause the liquid to engage the fabric flatways while it is in a substantially vertical position and is being fed through the vat. When the apparatus is used for scouring, a reciprocating, rotating, or other brush is placed above one of the feed rollers. —T. W.

Folding Fabrics: Bolts and Rolls of Fabric. T. E. Bagnall and T. E. Bagnall, Manchester. E.P.173,406, Jan. 5, 1922. (Appl. No. 33,250/20.)

Apparatus for folding fabrics in steps in "Creafold" form comprises a supported cross-bar upon which needle-carriers are secured at the required intervals, an adjustable peak board with clamping devices to form a peak in one of the folds, and an adjustable rod over which the material can be folded longitudinally and removed with the peak board. —T. W.

6.—ANALYSIS, TESTING, GRADING, AND DEFECTS.

Chemical Properties of Cotton. C. E. Mead. Textile World, 1921, **60**, 3,501.

The author reports that experiments of the Cotton Research Co. have shown that the removal of wax increases the strength of cotton yarn by 15-20%, the yarns being tested under the same conditions of humidity. This is probably due to increase of friction. On the other hand, removal of the wax is likely to reduce the wearing properties of the yarn. There is also a relation between the amount of wax and the percentage of short fibre in a sample of cotton. Consequently, many of the theories of the action of the wax may have to be revised by paying more attention to the short fibre. —J. C. W.

Flax; Contribution to the Knowledge of the Pectic Substances of—. E. Correns. Faserforschung, 1921, **1**, 229-240.

A chemical study of the pectic substances present in flax. Previous work on the subject is reviewed, and methods of work and analysis are described in detail for obtaining the pectic substances from flax. The pectins of straw, rippled and heckled flax, were only distinguishable in their methoxyl-contents and in their solubilities. It is pointed out in the conclusion that the properties of lustre, feel, and also elasticity are intimately connected with the pectic substances present. It remains to be ascertained by further investigations whether these pectic substances can find uses in processes for improving the qualities of textile fibres, and whether they can be rendered insensitive to agents used in dyeing and bleaching and to later processes in manufacture. —W. R.

Textile Fibres: Adsorption and Scouring. H. Grimm. Zellstoff u. Papier, 1921, **1**, 37-56.

The results of some experiments on the adsorption of calcium hydroxide by bleached and unbleached cotton, also linen and flax, are given. The relative merits of lime and caustic soda for the scouring of different fibres are discussed. Laboratory experiments and large scale boils are described in which the effect of the different alkalis and conditions of boiling on the constituents of the fibre has been studied. It is shown that previous adsorption of lime has no influence on the boil. Steaming, unless under pressure, is not efficacious. The introduction of carbon dioxide for loosening the fibre has no effect. Soda boiling after previous adsorption of lime has no greater effect than ordinary boiling. —J. C. W.

Colour Theory. M. Becke. Mitt. Forschungsinst. Text. Ind., Wien, 1920, **1**, 3-82 (Feb.) and 10-15 (May).

A full account, from fundamentals, of the theory of colour as applied to textile fabrics. After discussing colour under the headings (1) source of light, (2) coloured object, (3) observer, the author draws some 20 conclusions and then discusses the complete process with reference to Ostwald's theory. —J. C. W.

Cellulose Content of Pine Wood; The——. P. Klason. Jl. Chem. Soc. (from Zellstoffchem. Abhandlungen, 1921, **1**, 105-114), 1922, 122, Ai, 99.

Cross and Bevan's method, it is stated, cannot be used for the estimation of the cellulose content of pine wood. The author has investigated the action of a solution of 80 grams of sodium hydrogen sulphite and 500 c.c. of N-hydrochloric acid in 1 litre of water for varying periods of time at 100°. After 8 days, the cellulose reaches a nearly constant value, and, with continued heating, only slowly decreases (1·7% in 13 days). —L. M. S.

The Applicability of Kelpchar as a Bleaching and Purifying Agent. J. W. Turrentine and H. G. Tanner. Jl. Ind. Eng. Chem., 1922, **14**, 19-24.

The efficiency of kelpchar as a decolorising charcoal is described. The material is being manufactured at the rate of about 1,000lbs. per day as a bye-product in the recovery of potassium salts from kelp. —J. C. W.

Cellulose Nitrates. G. de Bruin. Jl. Chem. Soc. (from Rec. trav. chim., 1921, **40**, 632-664), 1922, **122**, Ai, 13.

A resumé is given of the more generally accepted views as to the constitution of cellulose from the point of view of its nitration products and also of the various methods of determining its stability and the ratio of nitrogen content to stability. Details are given with regard to the cellulose, acids, nitration, stabilisation, and method of sampling and of carrying out estimations of nitrogen content. A review of work on the solubility of cellulose nitrates in mixtures of alcohol and ether is given. The author infers from his results that there are simple cellulose nitrates with nitrogen content 12% and 12·5% respectively; the substance containing 12·75% of nitrogen is shown to be present as a mixture of two isomerides, one of which is soluble in a mixture of alcohol and ether, the other being insoluble. These results are in accordance with the theory put forward by Vieille. —L. M. S.

Oxycellulose; Identification of—by means of the Barium Compound. E. Becker. Jl. Chem. Soc. (from Zellstoff u. Papier, 1921, **1**, 5-7), 1922, 122, Aii, 94.

When 2 grams of oxycellulose are shaken with 50-60 c.c. of barium hydroxide solution for 4 hrs., and the insoluble portion is washed with water until the filtrate is free from barium compounds, a barium compound of oxycellulose remains, of which the content of barium varies according to the origin of the oxycellulose. —L. M. S.

The Determination of the "Bromine Figure" or "Chlorine Factor" of Pulp, and the Utilisation of these Quantities in Bleaching. A. Tingle. Jl. Ind. Eng. Chem., 1922, **14**, 40-42.

The extent to which bromine solutions, approximately decinormal, act on cellulose and on unbleached sulphite spruce pulp has been investigated. It is found that accurate measurements are only possible when the material is brought into solution before treatment with bromine, and then there is no reaction between bromine and cellulose within 30 min. Reaction between bromine and pulp (containing lignone) seems to proceed in definite steps, one of which is completed within 30 min. From measurements of this action, a quantity is found which bears a definite and simple relation to the chlorine consumption in bleaching. —L. M. S.

Wood and Wood Pulp; Chemical Changes Involved during Infection and Decay of——. M. W. Bray and J. A. Staidl. Jl. Ind. Eng. Chem., 1922, **14**, 35-40.

A study of the chemical changes involved during infection and decay of wood and wood pulp. The results of typical analyses of sound and infected spruce woods are tabulated and of the pulps made from these woods. Infected woods are inferior to sound woods in that:—The cold and hot water-soluble materials increase during decay; higher alkali-soluble materials are found showing a lower resistance to the action of chemical agents; there is an increase in copper number; in cases of extreme decay the rate of degradation of lignin and cellulose is selective and not uniform; lower percentage of α, stable, cellulose, higher percentage of β, less stable cellulose, is present. —J. C. W.

Photochemistry; Investigations on the Fundamental Law of——. P. Laserez. Jl. Chem. Soc. (from Z. physikal. Chem., 1921, **98**, 94-97), 1922, **122**, Aii, 103.

A theoretical discussion of work previously published on the bleaching of dyes by light (see *Jl. Chem. Soc.*, 1912, Aii, 219; *Ann. Physik*, 1907 [iv], **24**, 661). The experiments on bleaching in the presence of oxygen under increased pressure (up to 150 atm.) are particularly considered. The form for the fundamental law for the bleaching of dyes is given. —L. M. S.

Viscose Silk; Composition of——. C. G. Schwalbe and E. Becker. Zellstoff u. Papier, 1921, **1**, 168-170.

In an article on the behaviour of cellulose incrusting substances in the manufacture of viscose silk the results of analyses of several samples of viscose silk and their corresponding raw materials are tabulated. Furfuraldehyde determinations show that the viscose process brings about a purification of the cellulose. Wood cellulose is freed from its lignin constituent. The ash content of viscose silk manufactured from wood cellulose is considerably lower than that of the raw material. An increase in ash content is to be observed in that manufactured from cotton. The hygroscopicity of viscose silk from cotton is nearly twice that of the cotton itself. The difference between the values is much less in the case of silk manufactured from wood cellulose. Viscose silk differs chemically from alpha-cellulose in its higher content in incrusting substances. Other conditions being equal, the incrustation content of the finished silk depends on the purity of the raw material. Viscose silk is pure cellulose hydrate. It is chemically identical with cellulose, but differs from it in certain adsorption reactions, *e.g.*, iodine colouration and the adsorption of water and Fehling's solution. —J. C. W.

Studies on Plant Colloids. XII. Effect of Formaldehyde on Cellulose. M. Samec and S. Ferjancic. Kolloidchem. Beihefte, 1921, **14**, 209-226.

Cellulose when in the form of an emulsoid forms an additive compound with formaldehyde. It is assumed that the addition takes place through the opening of an oxygen ring in the cellulose molecule and the formation of an oxymethylene group. Cellulose-dextrin acts in an analagous way. Tables are given comparing the appearance, reactions with iodine solution, electrical conductivity and viscosity of sulphuric acid solutions of cellulose with and without the addition of formaldehyde. —J. C. W.

Cloth; Testing——. M. Becke and F. Schubert. Mitt. Forschungsinst. Text. Ind. Wien, 1921, **1**, 8-9 (May).

The authors state that two instruments have been devised, now ready for patents, by means of which numerical values can be given to factors which more closely correspond with the real wearing properties of a fabric than mere tensile strength or extensibility. No details are given. —J. C. W.

7.—BUILDING AND POWER.

(B)—Fire Prevention.

Spontaneous Combustion in Textile Works through Oils. See Section 10.

(C)—Power.

Looms; The New Oerliken Geared Individual Drive for——. Electrician, 1922, **88**, 235.

For individual motor driving of looms running below about 160 r.p.m. belts are not suitable. Gearing is the rational driving medium, but it will not withstand the shock to the teeth when a loom bangs off. To get over this difficulty an automatic centrifugal coupling is introduced between the motor spindle and the pinion, and this slips if for any cause an excessive load comes on. A special stand for conveniently supporting the loom motor is illustrated. The efficiency of this drive is from 6 to 10% higher than the belt drive even for favourable speed ratios. —V. M.

Auto-Regulated Drying Chamber. Textilberichte, 1922, **3**, 79.

An electric drying chamber with autoregulator is described. The regulator depends on the following principle. A contact thermometer is operated by the different expansions of a tube and rod of nickel-steel. On reaching the desired temperature, this interrupts a platinum contact and opens the main current with the help of a mercury relay. The drying chamber is made of aluminium and packed, between the inner and outer walls with asbestos. —J. C. W.

Recent Developments in Textile Drives. Electrician, 1922, **88**, 233.

Deals with electric motors made for textile driving by the firm which first introduced the variable speed A.C. motor for ring frames, and which also subsequently much improved this motor. A recent development is an enclosed speed reduction gear built on to the motor frame; this has ground pinions running in an oil bath with an efficiency of 98-99%, and it enables the most suitable motor speed to be chosen even when this does not coincide with the speed of the driven machine. For ring frames, the automatic variation of speed for the purpose of maintaining constant yarn tension has proved very successful. —V. M.

Ball Bearings for Textile Works. Electrician, 1922, **88**, 228.

Test figures are given for two 80 spindle jute frames, one equipped with plain bearings and the other with ball bearings on the tin roller and spindles. The power consumption is 25·23 spindles per h.p. on the ball bearing frame, against 16 to 18 on the plain bearing frame. Speed was increased from 2,700 to 2,850 r.p.m. on the ball bearing frame and the production was 28·5 lbs. in 37 mins., against 27 lbs. in 38 mins. on the plain bearing frame. The improvements brought about in small electric motors by the application of ball bearings are noted, and it is stated that the development of individual drive for most types of textile machines is being retarded chiefly because the textile machinist has done little to make his machines suitable for such driving. —V. M.

Power Consumption Tester for Looms. P. Beckers. Textilberichte, 1922, **3**, 48-50.

The author describes instruments for measuring the consumption in order that looms may be constructed on the most economical principles. The instruments include the dynamometer of Rieter and an efficient oscillograph. —J. C. W.

Electricity in the Lace Industry. J. F. Crowley. Electrician, 1922, **88**, 225.

Describes the evolution of lace manufacture. The chief features of the lace machine from the power point of view are:—High starting torque; great cyclic variation in torque and delicacy of the mechanism and liability to serious "smashes." These features demand a steady drive unaffected by external causes and electrical driving is ideal. The cyclic variation in torque can be met and the "smash" difficulties are minimised by the provision of an automatic slipping coupling. Illustrations are given of individual drives of lace machines and also of the other machines in a lace factory. —V. M.

Mechanical Storage of Water Power as a Factor in Textile Production. Electrician, 1922, **88**, 229.

A hydro-electric plant with unusual features has been installed at the mills of a Scotch firm. The mills require 450 h.p., but only 220 h.p. is available from the river. To make up the deficiency a reservoir holding 3,000,000 galls. has been built on a hill 1,000ft. above the river, and water is pumped into it through a 9in. pipe line when the mills are not working, and drawn off to drive a Pelton wheel during working hours. The power is obtained from the river by means of two 110 h.p. turbines which drive by belts on to the two shaft ends of one dynamo during working hours, while at other times the belts are shifted on to the pulleys of two pumps. The Pelton wheel develops 230 h.p., and is direct coupled to a second dynamo which runs in parallel with the first one. —V. M.

Electric Driving of Scottish Woollen Mills. A. W. Stevenson. Electrician, 1922, **88**, 217.

Many small mills in the Scottish woollen trade carry out the complete process from fleece to fabric. There is a good field for the heat extraction engine or turbine. Existing mills when turned over to electrical driving will mostly be group driven, using existing mill gearing; the main difficulty is the slow speed of the line shafts, which vary from 130 to 55 r.p.m., and double reductions from motor to shaft are frequently necessary. The processes are described in order, and the main features of the driving requirements pointed out. —V. M.

(E)—TRANSPORT.

Conveyor System. G. H. Goldsmith. Textile World, 1922, **61**, 373.

The American mill described was built two years ago, and equipped with mechanical means for all mass handling of stock. The initial idea was to use gravity as much as possible, but experience has discounted this method. Changes have been made, and the tendency is towards entirely controlled positively driven mechanisms. The equipment comprises spiral chutes, band conveyors, inclined and vertical elevators, many of which are illustrated. The operation of the plant results not only in labour saving but also in a remarkable reduction of stock in process. —V. M.

Motor Transport; Real Economy in——. M/cr. Guard. Commercial, 1922, **55**, 365.

Describes the performance of a 3½ ton lorry fitted with the "Sphere" gas producer plant, showing a saving of 80% in fuel cost as compared with petrol. —V. M.

9.—COMMERCE, ECONOMICS, LABOUR, ORGANISATION, COSTING, &c.

Flax Growing in Soviet Russia. Belfast News Letter, 1922, March 7, 3.

A table is given showing how the area sown with flax has steadily diminished since 1916. It appears that the yield is very small—or else the acreage has been over-stated, which is probably the correct interpretation. At the present time Soviet Russia has practically no flax for exportation. —F. B.

Japan Silk Outlook. Textiles, 1922, **20**, 31.

The 1921 crop is only 5% below that of the previous year instead of 15% as estimated; it will total 6,000,000 koku (of 5·12 bushels). Owing to suspension of reeling, there will probably be 5½ million koku of superior silk. Of raw silk of all qualities the output is expected to be 37 million kin (of 1⅓lb.), but it is thought that not more than half will be put on sale during the current silk year. From July 1 to Sept. 30 71,521 bales (of 133⅓lb.) were exported, and 30,000 used at home. From July to October, Europe received 8,703 bales and America 83,154 bales from Japan. —F. G. P.

Japanese Crêpe; To Improve——. Amer. Silk Jl. (from Japan Advertiser), 1922, **41**, 72.

A joint commission is being formed by the Fukui silk crêpe makers to maintain the highest standard of excellence in goods for export; every piece is to be passed and stamped. —F. G. P.

Manchurian Silk for Japan. Amer. Silk Jl. (from Japan Chronicle), 1922, **41**, 54.

The Japanese Department of Agriculture and Commerce is preparing estimates for factories, etc., to weave Manchurian silk into pongees; 1,600,000 yen is to be spent on enlarging the Yokohama laboratories. —F. G. P.

Empire Cotton Growing Corporation; First Annual Meeting of——. See This *Jl.* (Proc.), 1922, **13**, 50.

Industrial Fatigue Research Board. See This *Jl.* (Proc.), 1922, **13**, 51.

10.—MISCELLANEOUS.

Ostwald Colour Theory; Importance of the——in Dyeworks. H. E. Ristenpart. Textilberichte, 1922, **3**, 63.

The following advantages are claimed for the theory in relation to practice:—The limitation of approximately one million shades to comparatively few normal colours; greater reliability of the patterns; possibility of dispensing with special patterns. At present, 680 normal shades have been prepared on paper; the latter has been used in preference to textiles because complications due to the angle of vision do not arise as with textiles because of shade effects and the effect of weft and warp. It is admitted that many important shades used on textiles are not yet found in the colour atlas. The Chemnitz school claims that the technical incompleteness of the series of normal colours prepared indicates no flaw' in the theory itself. —E. B. A.

Colour Measurement and the Importance of Fluorescence and Polarization Phenomena in Such Measurements. Lagorio, A. Textilberichte, 1922, **3**, 65.

The writer considers that the inability tc characterise all shades by the Ostwalc method lies in our lack of knowledge o the many important optical properties o fabrics which produce the visible shade The type of reflection causing the phenomenon of lustre must be taken intc account. Many colours show a differenc when viewed horizontally or vertically. In substances with a rough surface, the tru colour will be altered by the presence o white and black. Reflection, absorption refraction and dispersion can be allowe for, but interference in thin layers diffraction, true dichroism, and especiall polarization and fluorescence, so far, can not. The writer recommends tha fluorescent colours should not be used fo making normal shades on account of th considerable errors they introduce. —E. B. A

Spontaneous Combustion in Textile Work through Oils. Spinner und Webe 1922, No.6, 7.

Numerous fires have been caused b oxidation of the oil in fibres, not only i the case of cotton wool, but also of tov flax, hemp and jute. In an experime with cotton treated with boiled linseed o insulated from external cooling, th temperature rose 11°C. in 24 hrs., where an exposed mass only deviated 2°C. fro the external temperature. Light plays n part beyond the direct heating effect of th sun's rays. Micro-organisms and enzym play no part. As regards different oil under the conditions of experiment, ra gave no heat development, cotton seed c very slight, raw linseed stronger a boiled linseed very considerable. T greatest heat development was observ with silk, and then, in descending orde wool, cotton, jute and hemp. The insu tion against heat loss is an importa factor in spontaneous combustion becau oxygen absorption is much more energe as the temperature rises. —E. B.

Telephone Service Efficiency. See Th *Jl.* (Proc.), 1922, **13**, 41.

ABSTRACTS

I.—FIBRES AND THEIR PRODUCTION.

(A)—MINERAL.

Asbestos Occurrences near Kaapsche Hoop. A. L. Hall. S. African Jl. Ind., 1922, **5**, 112-115.

Describes the mode of occurrence, fibre quality and length of the chrysotile asbestos worked on the farm Joubertsdal in the Barberton district of the Transvaal. —L. M. S.

(B)—ANIMAL.

Silk Culture in Brazil. U.S. Commerce Reports, 1922, Mar. 13, 616.

The Brazilian Ministry of Agriculture, through its sericulture experiment station at Barbacena, has made sufficient headway for the incorporation of a company to erect a modern silk factory at Campinas, Sao Paulo. Mulberry trees are grown with considerable success in Brazil and silkworms have so far escaped serious epidemics. —L. M. S.

Bhagalpur Silk Institute. Jl. Indian Ind. and Labour, 1922, **2**, 116.

The institute is devised to carry out the main recommendations made in Professor Lefroy's report on the silk industry. Experiments will be made to see whether mulberry and *eri* silk can be cultivated at Bhagalpur, and other silks besides *tasar* will be introduced among the weaving population. Attempts will be made to devise suitable means of twisting *tasar* and generally to improve the processes of reeling and weaving silk. —L. M. S.

Sheep Raising in Alaska. Nat. Assocn. Wool Mfrs., Annual Wool Review, 1921, 181.

According to "Stock and Land," sheep raising on the Aleutian Islands has passed the experimental stage. In 1918 the Umnak Live Stock Association was formed and placed 600 head of sheep on the island. It is estimated that the range of the island is sufficient to accommodate 2,000,000 sheep. —L. M. S.

Turkey: Silk. Bd. of Trade Jl., 1922, **108**, 335.

The silk production of the Broussa district for 1921 was 1,350,000 kg., as against 950,000 kg. in 1920. The production per unit of seeds has been higher, owing to less hatching and greater attention to feeding. The output of silk was 1 kg. of raw silk from 11-12 kg. cocoons.—F. G. P.

Silk Growing in Egypt. Women's Wear, N.Y., 1922, **24**, 6.

Experiments are being made on the banks of the Nile in Sudan in cultivating *Aacus ricini*, a silk moth yielding a somewhat coarser silk than *Bombyx mori*.—F. G. P.

Sericulture; Department of——, University of Nanking. Silk, N.Y., 1922, **15**, 48.

A report on the influence of the department's work in production of disease-free seed, hybridisation, raising of worms from cold storage seed, etc. —F. G. P.

Report of the Department of Agriculture of Bengal, 1920-21. See This *Jl.* (Proc.), 1922, **13**, 69.

Wool Statistics. See Section 9.

(C)—VEGETABLE.

North Africa as Source of Flax. Times Trade Supp., 1922, **10**, 54.

The straw of North African flax is generally short and of bad quality. Attempts have been made to introduce the Riga variety, and in 1920 and 1921 over 800 acres were sown. There is a factory at Medjez-el-Bab, where 10 tons of fibre are dealt with daily. France wishes to cover the whole of the requirements of her linen industry by growing sufficient flax in her North African possessions, which would mean the cultivation of nearly 200,000 acres in Tunis, Algeria and Morocco. —L. M. S.

Cotton and Kapok at Guam Agric. Expt. Station. Report of the Guam Agric. Expt. Sta., 1920, 33-34.

A number of varieties of cotton were tested and the yields recorded. It has been found that it is not profitable to grow kapok lint on a commercial scale in Guam, as the tree is a low yielder. —L. M. S.

Cotton Conference in Brazil. U.S. Commerce Reports, 1922, Mar. 13, 620.

At the conference to be held at Rio de Janeiro in October, 1922, at the instigation of the Sociedade Nacional de Agricultura of Brazil, the following topics are to be discussed:—Methods of combating cotton pests; insecticides and fungicides; methods of cleaning cotton seeds; importation of cotton seeds; irrigation; cotton gins and other machinery; cotton by-products; cotton linters for paper manufacture. —L. M. S.

Pima Cotton. Cotton, 1922, **27**, No.1325, 2.

It is stated that growers of long staple cotton in the Salt River Valley expect to plant 85,000 acres of Pima in 1922—an increase of 20% over the acreage harvested in 1921. No Pima cotton will be planted in Yuma valley this year, only medium staple cotton being produced on the 20,000 acres estimated. —L. M. S.

Annual Report of Department of Agriculture, Uganda, 1920. See This *Jl.* (Proc.), 1922, **13**, 69.

Report of the Department of Agriculture of Bengal, 1920-21. See This *Jl.* (Proc.), 1922, **13**, 69.

Cotton Hair; The Structure of the——and its Botanical Aspects. See This *Jl.* (Trans.), 1922, **13**, 99.

Report of Department of Agriculture, Barbadoes, 1920-21. See This *Jl.* (Proc.), 1922, **13**, 69.

(D)—ARTIFICIAL.

Artificial Silk in Brazil. See Section 9.

PATENTS.

Preparing Fibres for Spinning: Rippling Apparatus. J. C. Stewart, Crossgar, Ireland. E.P.173,893, 13/1/22.
Flax straw is held in a frame and the seeds removed by a pair of combs carried by a frame reciprocated by a crank and connecting rod. The movement of the frame closes and opens the combs as required to engage the flax and to disengage the combs. The degree to which the combs penetrate the flax is regulatable, whilst the frame is rocked automatically to bring first one and then the other bundle of flax into position to be operated upon.

Threads, etc., from Cellulose Ethers. H. Dreyfus, London. E.P.174,660, 6/2/22.
Films, sheets, threads, filaments, etc., are made from ethyl, methyl, benzyl and other ethers of cellulose by running, casting, extruding or otherwise working the ethers when in a melted condition. The ethers may be mixed with nitrocellulose, cellulose acetate and other esters of cellulose, and plastifying agents and colouring materials may be added.

Webs, Sheets, and Moulded Articles of Fibrous Cellulose. C. F. Cross, London. E.P.173,971, 19/1/22.
Fibrous hydrated cellulose, produced by process as in Spec. 126,174 and formed into sheets on a paper machine or into moulded articles, are reverted back to fibrous cellulose, during the final stage of felting on the paper machine or in the mould, by treatment with a reagent containing an acid or acid group in sufficient quantity to react with the whole of the soda present. Weak acids may be used.

Preparation for Destroying Boll Weevils. Benjamin R. Gray, Willacoochee, Ga. U.S.P.1,403,403, 10/1/22. Appl. 27/5/20.
Consists of a smoke resulting from the ignition of a liquid composed of kerosene and coal tar substantially in the proportion of eight parts to one respectively. —T. W.

Cotton Spacer. Howard O. Wilkinson, Kingfisher, Okla. U.S.P.1,402,819, 10/1/22. Appl. 28/4/21.
The implement comprises a handle, a pair of spaced arms secured to the outer end thereof and having their ends terminating directly opposite one another, a pair of diversion braces secured at their inner ends to the handle and extending beyond the outer end thereof, being bent at points opposite one another and opposite the outer end of the handle so that their free end portions extend in parallelism with the outer end portions of the arms, the extremities of the braces terminating opposite the free end of the latter, and a pair of spaced cutting strips having their opposite ends bent laterally inward and secured to the ends of the adjacent arms and braces. —T. W.

Flax Pulling Mechanism. John Magill, Milford, Mass. U.S.P.1,403,262, 10/1/22. Appl. 12/10/20.
Comprises a rotated cylinder, a plurality of axially movable flax gripping members mounted thereon, a flax carrier mounted therewith, a pair of fixed cams directly engaging and longitudinally reciprocating the said members positively in both directions as the cylinder is rotated, to grip and thereafter release the flax and to deposit it on the carrier. —T. W.

2.—CONVERSION OF FIBRES INTO FINISHED YARNS.

(A)—PREPARATORY PROCESSES.

Flax Preparing Machinery; Possibility of Determining Analytically the Pitch and Number of Gill Pins in——. E. Acheray. L'Avenir Text., 1922, **4**, 234-240.
Up to the present time the data followed in determining the quantity, gauge, and pitch of gill pins in various flax preparing machines has been handed down by tradition. In this article the subject is dealt with analytically and theoretically with a view to arriving at definite formulæ, which when applied in practice will give correct and satisfactory results. This study is divided into four heads:—(*a*) Observational results, (*b*) hypothetical reasoning, (*c*) mathematical deductions and interpretations of (*a*) and (*b*), (*d*) practical applications and experimental verifications. It is claimed that by the method of procedure shown, it is possible to determine positively the pitch of gills which, say, a drawing frame should have, if the pitch of the gills of the roving frame be known, and also if the drafts and doublings to be given on the machines following this particular drawing frame be known. —A. H. M.

(B)—SPINNING AND DOUBLING.

New Thread Twisting Machine. Jl. Roy. Soc. Arts, 1922, **70**, 339.
The main principle of a new twisting machine for the textile industry, invented

by a Norwegian factory owner, is that the bobbins rotate simultaneously with the spools receiving the spun thread, causing the twisting of both ends. This gives greater firmness and strength to the thread. It is claimed that this machine twists seven times as fast as older machines. —J. C. W.

(C)—SUBSEQUENT PROCESSES.

" Imp " Yarn Cleaner Gauge. Text. World, 1922, **61**, 1,145.

This device is intended to clean the yarn in the winding room, removing slubs and foreign matter. The cleaning is done without damage to the yarn by scraping. The gauge is adjustable for different counts of yarn. It also acts as a check on yarns, for if it is adjusted to a certain count of yarn it will not accept one slightly different. —J. C. W.

(D)—YARNS AND CORDS.

" Imp " Yarn Cleaner Gauge. See Section 2C.

Application of Photography to Textile Research. See Section 6.

PATENTS.

Spinning: Ring Spinning. P. C. Wentworth, Providence, R.I., U.S.A. E.P. 174,068. Conv. 11/1/21.

To avoid the loading of the traveller with lint, etc., it is formed with a slot or other aperture in the bow portion.

Spinning: Spindle Apparatus. S. J. Flight, Chandernagore, India. E.P. 174,122, 16/1/22.

The wharl of spindle is mounted on a bush screwed into the arm of a knee-bracket fixed to the neck rail so that strain due to tension of driving band is not transmitted to the spindle. The bush is bored to allow the spindle to revolve therein with clearance.

Spinning: Spindle Apparatus. J. W. Twistleton, Steeton, near Keighley. E.P.174,503, 2/2/22.

Where yarns or threads are wound upon bobbins or spools mounted on tubes revolving upon stationary spindles, the wooden or other wash supporting the tube is provided with a shield or sleeve which shrouds the lower end of the wharl, thereby preventing choking of space between tube and spindle by loose fibre.

Viscose Silk. E. Bronnert, Mulhouse, France. E.P.172,038, 28/11/21.

Glucose, glycerine, glycol, or other polyhydric alcohol added to acid bath prevents parchmentising of the thread and simplifies working. —F. G. P.

Artificial Silk. F. J. Brougham (from Technochemia Akt., Switzerland). E.P. 171,776, 21/11/21.

Brilliant viscose threads freshly spun in an acid bath are wound on bobbins in a neutral ammonium salt bath. The neutrality is maintained throughout by addition. —F. G. P.

Serving Spindle. G. L. Mason, Warehouse Point, Conn., Assr. to J. R. Montgomery Co. U.S.P.1,403,180, Appl. 20/10/19, and 1,403,181, Appl. 1/9/20, 10/1/22.

A rotating spindle, a sleeve positioned thereon, a spool entirely supported by said sleeve, and having a cylindrical portion of greater diameter than the external diameter of said sleeve, and interengaging means adjacent each end of said sleeve and cylindrical portion of the spool for holding said sleeve and spool in spaced relation. The other device consists of a flyer for laying a covering strand on to a core strand, and a stationary bridge between said flyer and the winding point and over which the covering strand is drawn. —T. W.

Yarn Stripper. Harmon C. Springstead, Hamilton, Ontario, Canada. U.S.P. 1,403,354, 10/1/22. Appl. 13/12/20.

The device comprises a pair of spaced discs concentric and rigid each with the other, said discs having a plurality of slots extending inwardly from their circumferences, the slots in one of the discs being disposed at different angles in relation to the slots in the other disc, each slot in one disc meeting and ending at a point in register with the terminus of a slot in the other disc co-operating therewith in forming the equivalent of round passages through both discs. —T. W.

Stop Motion for Spinning Frames. Thos. Grean Bullard, Enterprise, Ala. U.S.P. 1,403,386, 10/1/22. Appl. 22/8/19. (3 claims: 1 printed.)

Comprises a transversely disposed trigger or latch-bar spanning the frame and mounted for slight vertical movement but precluded from longitudinal movement, and having its extremities arranged in the path of movement of the ring rails, a belt shifter, and a spring-actuated shipper rod operatively engaged with said shifter and provided with a seat or notch for engagement by said latch-bar. —T. W.

Stop Motions for Winding Frames. Schubert and Salzer. G.P.777,463. L'Avenir Text., 1922, **4**, 262.

A spring support is placed between the thread guide and the thread support. The yarn passes through two gears, over the thread support, the spring and through the guide. There is a regulating device to regulate the yarn when it gets too slack or too tensioned. —A. H. M.

3.—CONVERSION OF YARNS INTO FABRICS.

(B)—SIZING.

The "Nivling" System of Standardised Sizing. Text. Merc., 1922, **66**, 223.

This device ensures a continuous circulation of size through the size box and at the same time automatically maintains the correct, desired level. It operates without the use of float valves or moving mechanism of any kind. Circulation of size is by gravity and a constant stream of fresh boiling size passes into the size box. Excess of size is taken from the floor of the size box, so that any lumps caused by congealing are automatically removed. Kettles containing light size or heavy size can be put into operation so that any slasher on the line of supply can be changed from light to heavy work in a few minutes. —J. C. W.

Application of Photography to Textile Research. See Section 6.

(C)—WEAVING.

Weaving the Van Heusen Collar. Text. World, 1922, **61**, 1,259.

In reply to a query *re* this article (see This *Jl.* Abs., 1922, **13**, 35) it is stated that the warps are not sized; they are of 2-60's yarn of a very high grade, which is absolutely necessary to get a perfect shed clearance. The yarn is warped in sectional warps on small beams on an ordinary narrow warping machine. —L. M. S.

The All-India Hand-Weaving Exhibition. R. D. Bell. Jl. Indian Ind. and Labour, 1922, **2**, 77.

A description of the weaving exhibits and machinery. —L. M. S.

(D)—KNITTING.

Knitting Machines. W. Spiers, Leicester. E.P.174,798, 9/2/22.

Splicing mechanism applicable particularly to machines with two co-axial opposed needle cylinders and mainly intended for half-round splicing above heel and along foot bottom of stockings, etc.

Knitted Fabric; A "Revolution" in—— See This *Jl.* (Proc.), 1922, **13**, 66.

(G)—FABRICS.

Ornament and Colour; Application of—— to Textile Fabrics. A. E. G. Brookes. Text. Merc., 1922, **66**, 300-301.

The different methods by means of which ornament and colour may be applied to fabrics are briefly reviewed. A number of suggestions were made with regard to the best method of developing and extending the cotton manufacturing industry of Lancashire in over-seas markets. —L. M. S.

Knitted Fabric; A "Revolution" in——. See This *Jl.* (Proc.), 1922, **13**, 66.

PATENTS.

Embroidery Machines. Bachert et Cie, Trübbach, Switzerland. E.P.172,598. (Appl. No. 5,868/21.) Conv. Dec. 6, 1920.

Square frames are mounted in the main work frame of a shuttle embroidering machine so that they can be turned to bring each edge uppermost in succession. Two rows of square frames are provided, one on each side of a central horizontal bar of the main frame. —T. W.

Loom and other Textile Machines: Cloth and Warp Beams. Fisher and Ludlow (1920), Ltd., and A. Shaw, both of Birmingham. E.P.173,416, Jan. 5, 1922. (Appl. No. 34,766/20.)

A flange is clamped to the warp beam or roller of a loom or other textile machine by a split band which is contained within a boss bolted on the flange. The band, retained in the boss by an inturned flange, is prevented from turning by a screw, and is clamped on a warp beam by a set-screw. —T. W.

Lace Machines. Sir E. Jardine, E. Watchorn and J. W. Swindall, of Nottingham. E.P.172,485, Dec. 15, 1921. (Appl. No. 29,739/20.)

To assist the operation of putting-up fresh sets of warp threads, the guide-bars of twist-lace machines, particularly plain-net machines, are mounted on arms carried on the inner ends of a number of horizontal levers loosely disposed on longitudinal shafts. The guide-bars can be raised out of the normal working position determined by stops by turning screws mounted in the bearings of fixed brackets, the screws turning in nuts, the projections of which engage recesses in the outer ends of the horizontal levers.—T. W.

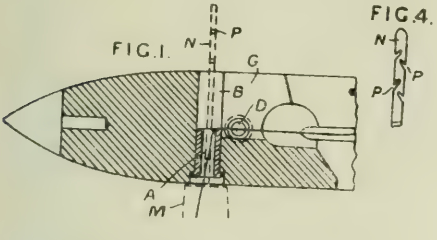
Woven Fabrics. J. Crompton, Lytham, and G. Bryers, Rio de Janeiro, Brazil. E.P.173,244, Dec. 28, 1921. (Appl. No. 17,259/20.)

Relates to the manufacture of tubular fabrics of an elastic character for enclosing carcases of frozen meat, etc. The yarns may be hard twisted, ordinary twisted, or both, while alternate threads in warp and weft may be of oppositely-twisted yarns. Dark and light threads may be employed, and the structure may be such that the outer surface is dark and the inner surface light. Two weaves are shown and two structures. Indelible woven identity marks or stripes may be formed down the centre or sides of the bag in various ways. —T. W.

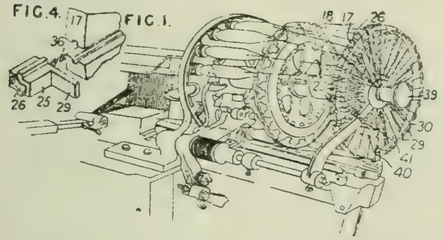
Embroidery Machines. H. Eberhardt, Switzerland. E.P.173,776. Conv. 5/1/21.

In Heilmann type machines the threads are pulled through the work by winding them round cylinders surrounding and rotating with the needle clamps.

Looms: Shuttle-threading. W. Stott, Hebden Bridge. E.P.174,230, 26/1/22. Shuttles having a vertical eye or two eyes A, D at right angles connected by a saw-cut G are threaded by means of pillar M secured to shuttle plate and carrying a vertical bar N notched on both sides. The shuttle is placed on the pillar so that bar N extends through a continuation B of eye A, and the weft is caused to engage one of its notches P. The shuttle is then raised, causing the weft to be drawn through the eye and to be placed in groove G in a position crossing the eye D. The shuttle is then placed over the pillar so that the bar extends through an extension of the bore of eye D; when the shuttle is again raised, the weft is drawn through eye D.



Looms: Shuttles; Changing Weft Carriers in——. British Northrop Co., Ltd., Daisyfield, Blackburn. E.P.174,263, 26/1/22. The weft-ends 18, Fig. 1, extending to the holder 39, are passed under clamping-springs 26, Figs. 1 and 4, on weft-end controllers 25 comprising ribbed blocks, which are guided radially in grooves in a head 17 rotating with the magazine, and have laterally extending shoes 29 engaging a fixed cam 30. The controllers 25 are acted upon by springs 36, and immediately after a weft-carrier has been transferred the corresponding weft-controller rides over the end of the fixed cam and is moved inwards suddenly into contact with a stop 40, so that the corresponding weft-end leading to the cloth selvedge is quickly withdrawn from dangerous proximity to the shuttle-box. As the head 17 continues to rotate with the magazine, the shoe on the inwardly-moved weft-controller engages the inner end 41 of the cam 30, and is caused thereby gradually to move outwards again.



Needle-threaders. R. C. Gardner, London. (B. Higgins, West Vancouver, British Columbia.) E.P.173,455, Jan. 5, 1922. (Appl. No. 9,912/21.) Hooks for drawing threads through needle eyes are formed on a strip of thin steel and on a smaller strip stamped out from or attached to the strip. The strips may be fixed to or pivoted upon a handle.
—T. W.

Embroidery Machines. H. Eberhardt, Rupperswil, Switzerland. E.P.173,775. Conv. 5/1/21. Heilmann type machines having revoluble cylindrical take-ups surrounding the needle-clamps are provided with mechanism for re-threading the needles.

Looms: Picking Spindles. W. L. Bird, Colne. E.P.173,938, 19/1/22. In a stud device the picking spindle is passed through a hole in the stud and is secured by an eye-bolt in a square hole in the stud, the stud being secured to the lay-sword, lay, or back of shuttle-box by a similar eye-bolt engaging a short rod inserted.

Jacquards or Dobbies for Weaving. M. C. Soeters, Neede, Holland. E.P. 174,508, 2/2/22. Has a needle-board made in sections, so that groups of needles can be placed opposite the lower and others opposite the upper row of holes in the sides of an iron needle-controlling cylinder or in perforated cards on a perforated wooden cylinder, one row of holes in each card being arranged to weave, for example, a warp-satin effect and the other a weft-satin effect.

Knitting Machines. K. Howie, Wildman Co., Norristown, Pennsylvania, U.S.A. E.P.174,902. Conv. 2/2/21. Two forms of pattern wheel for making tuckwork on circular knitting machines are described.

Fabric for Oil Wicks. John S. Brennan, Milwaukee, Wis. U.S.P.1,403,229, 10/1/22. Appl. 27/12/20. A wick strip is adapted to be fitted about a burner comprising a series of woven asbestos strands, each strand having its own wire core.
—T. W.

Warper Yarn Beam for Loom; Brake for——. G. Gerhardt. F.P.515,576. Appl. 28/1/18. The brake is formed by two pairs of regulable blocks surrounding the warper beam at its ends; these are freely mounted, and cannot turn on account of a shaft, parallel to the beam, placed above this. The draft is provided with a left- or right-handed screw or with a plush or a brush, so that the warp sized yarns are separated in working. The blocks of each pair are joined by a hinge so that they can be opened, and are maintained in a position of regulable shutting by a screw with nut.
—Eur. Text.

Braiding Machines. H. Wade, London (firm of Krenzler, Barmen, Germany). E.P.174,671, 20/1/22.

Relates to mechanism for controlling the movements of the bobbins in machines having the centre plates arranged in an arc of a circle. The bobbins are driven either by the plates themselves or by separate intermittently moved drivers mounted below stationary plates.

Pattern-Controlled Knock-off Means for the Stop Motions of Knitting Machines. Rinaldo A. Lukens, Collingswood, N.J., Assr. to Continental Mills, Inc. U.S.P.1,403,332, 10/1/22. Appl. 20/4/20.

A knitting machine having a rotating needle cylinder and a bed plate in which the cylinder is mounted, has a bracket carried by said bed plate, a shaft journalled in the bracket, a star wheel carried by said shaft, a lug carried by the rotating needle cylinder for periodic engagement with the star wheel to effect movement thereof one tooth at a time, a stop-motion actuating finger, a movable rod for operative engagement with said stop-motion actuating finger, and means controlled by said shaft for actuating said rod to move the stop-motion actuating finger. —T. W.

Friction Tape Fabric and Method of Producing. Fred B. Carlisle, Seattle, Wash. U.S.P.1,402,918, 10/1/22. Appl. 3/6/21.

Process consists in dividing a strip of fabric into a plurality of tapes, and in then applying rubber to form a homogeneous sheet. —T. W.

Warp Twisting-In Machine. John H. Becker, Brooklyn, N.Y., Assr. to Warp Twisting-in Machine Co. U.S.P. 1,403,067, 10/1/22. Appl. 24/11/20.

Mechanism for effecting release one after another of the cross threads of two sheets of warp comprises a revoluble hook-bar adapted to be interposed between the warp sheets and movable crosswise and against an edge of the warp to draw back the crossed threads; holding means for the warp also movable crosswise thereof, driving means, and means to transmit to the hook-bar from the driving means half-revolution movements and between such movements and to the hook-bar and warp-holding means reciprocations in opposite directions and crosswise of the warp. —T. W.

4.—CHEMICAL AND OTHER PROCESSES.

(B)—SCOURING AND DEGUMMING

Cottonisation of Bast Fibres. H. Schürhoff. Spinner u. Weber, 1922, No.11, 1.

By the cottonising process, short fibres are obtained either by mechanical or chemical means. By bacterial or chemical means, especially with intensive action, high yields of tow are obtained, which can no longer be used as the raw material for spinning. Fifty years ago Claussen introduced the use of flax wool, which was spun with cotton or wool, but this outlet for short fibres was not a success owing to the difficulty of spinning in machines built for the longer cotton fibre. During the war, one firm used flax, hemp and jute residues as well as nettle fibres for coarse cloths and also for more valuable fabrics. Jute residues were used in France before the war for making artificial worsted. The question has arisen again owing to the high cost of cotton. So far, no great advance has been made owing to the necessity for special machinery, new methods of working and practical experience. It is suggested that German hemp, normally of less value, short flax, and tangled flax straw might be utilised. The problem is also of interest to India, Canada and the Argentine. —E. B. A.

Saponification Scour; The——in Principle and Practice. J. Schofield. Jl. Soc. Dyers and Col., 1922, **38**, 76-78.

The saponification scour is a standard scour on heavily oiled woollens. In the case of good woollens it is assumed that the spinning oils are " oleins " with some mineral oil. The scouring of these goods is quite practicable by alkali alone in two stages. In the scouring of high-class worsteds the oiling is much less in quantity and neutral in character. Alkali of 2°—4°Tw. together with some soap is used from the outset. In the " low goods " scour, the conditions to be met are often incompatible, *e.g.*, the necessity of scouring at low temperature to prevent bleeding of dyestuffs, thus losing advantage of the enhanced wetting-out power of a warm scour. Attention is directed to some problems on detergents requiring further research. —F. C. W.

Cotton Fabrics; The Effect of Scouring and Bleaching upon the Structure and Strength of——. See Section 4G.

(G)—BLEACHING.

Bleaching Tussah Silk; Experiments in—. H. B. Shroff. Posselt's Text. Jl., 1922, **30**, No.2, XX.

The cloth examined is often spoken of as " Kashmere silk," and was of a yellow-reddish tint. It was almost unacted upon by concentrated hydrochloric acid, chromic acid and zinc chloride, all of which dissolved mulberry silk. The action of boiling 10% caustic soda was slow. Soda ash, and soap, both followed by hydrogen peroxide partly bleached it, reducing the lustre. Hydrogen peroxide and sodium silicate preserved the lustre and were equally good in reducing the colour. The best result was obtained by boiling with 1°Tw. hydrochloric acid, then treating with 3°Tw. caustic soda for a few minutes and finally with ½°Tw. ammonium hypochlorite, washing after each. —F. G. P.

Peroxide Bleach; The——. W. Francke. Textilberichte, 1922, 3, 108.

Attempts were made to carry out kier boiling and bleaching simultaneously, using peroxide. A sample of Louisiana cotton with a fairly thick cuticle was used in yarn form. In spite of prolonged action with the peroxide in moderately strong alkali at 90—100°C., the cuticle was not completely removed, but remained as yellowish spots on the yarn. With fibres having a thin cuticle a good product can be obtained, but even then there is too much non-cellulose left and fat removal is incomplete. Experiments were then carried out under pressure, the cuticle was removed and almost all accompanying substances, but the quantity of peroxide used was too great, owing to more impurities being removed, which then suffer oxidation at the expense of the peroxide. No formation of oxycellulose was observed in either case. If the bath is too alkaline oxycellulose is formed and vigorous oxygen evolution conditioned by catalysts sets in. With a bath much less alkaline than kier liquor, oxygen evolution is slow and regular, but even under pressure non-cellulose removal is not quite complete and yellowing is to be feared. —E. B. A.

Alkaline Peroxide Bleaching Liquor. L. Kollmann. Mitt. Forschungsinst. Text. Ind. Wien, 1921, 1, 16-24 (May).

A series of experiments on the effect of various alkaline oxygenated bleaching baths on cotton are described. Sodium and hydrogen peroxides and sodium perborate were used as oxidising agents, and caustic soda, sodium carbonate, waterglass and soap as the alkalis. Tables are given showing the loss of strength caused by the use of these chemicals separately and combined, and the bleaching effects produced are discussed in relation to the figures for strength. —J. C. W.

Cotton Fabrics; The Effect of Scouring and Bleaching upon the Structure and Strength of——. J. Huebner. Jl. Soc. Dyers and Colourists, 1922, 38, 29-40.

The total and individual effects of scouring and bleaching operations on the structure and strength of cotton fabrics have been studied and are described in detail. Scouring is responsible for an increase in the number of warp threads per inch and a decrease in the number of weft threads. Attempts to stenter the scoured fabric to its grey width result in reducing its tensile strain weft way. The fact that finishers should not apply too much tension during stentering is again emphasised. The importance attached hitherto to results obtained by removing warp and weft threads of a fabric and ascertaining their tensile strength in order to determine the effect of chemical agents and mechanical processes on the strength of the fabric is not justified. The results obtained by testing single threads are not directly comparable with either the tensile or the ripping tests.—J. C. W.

Cotton Bleaching; Notes on Recent Advances in——. S. R. Trotman and S. J. Pentecost. Jl. Soc. Chem. Ind., 1922, 41, 73-74T.

The logical and chemically sound way of replacing the ordinary lye boil would be:—(1) Warm sour; (2) degrease with benzene; (3) soda ash boil at ordinary pressure. Sodium hypochlorite penetrates goods better than the calcium compound; its action is more easily controlled and the danger of producing oxycellulose is less. Reference is made to the use of warm bleaches, the principal advocate of which is Freiberger, who contends that, with strengths up to 1 gram per litre of chlorine, bleach liquors may be heated to 40°C. with perfect safety. —F. C. W.

Bleaching Paper Pulp. E. Sutermeister, Chem. Abstr. (from Paper Industry, 1921, 3, 955-958), 1922, 16, 491-492.

Experimental results depend on the method of adding the bleach. Either an excess is added and the residue removed by washing or only the correct amount of bleach is added and exhausted. In the first case, increasing the concentration increases the rate of bleaching, does not materially affect the colour, but favours dirt and shives. Raising the temperature shortens the time of bleaching. About 120°F. appears to give the best results. The water used is important. Some river water high in organic matter consumes appreciable amounts of chlorine, as do weak liquor residues from insufficient washing and back waters. The use of back water is a doubtful economy. A saving of 10% has been effected by adding one-third of the total bleach, then washing before adding the remainder. The use of acid at the end of the process when the bleach is nearly exhausted is beneficial. Colour is most likely to go back at the higher temperature, and when the bleach is completely exhausted and the stock remains standing for some time in contact with spent bleach liquors. On a laboratory scale, it is possible to correct the colour of fibre which has "gone back" by the addition of very small quantities of bleach. On a mill scale, this is impracticable. —J. C. W.

Sulphate Cellulose. See Section 6.

Bleached Fabric; Yellowing of——. See Section 6.

(H)—MERCERISING.

Cotton: Mercerisation. P. Karrer, M. Staub and A. Walti. Helv. Chim. Acta, 1922, 5, 129-139.

In a paper on inulin and the alkali hydroxide compounds of the anhydrosugars the authors state that the potassium hydroxide compounds seem to be more easily dissociated than the analogous sodium hydroxide compounds. They suggest that this probably explains the fact that in the mercerisation of cellulose the solution must be more concentrated if potassium hydroxide is used than if sodium hydroxide is employed.—J. C. W.

(I)—DYEING.

Chlorate Discharge Paste. H. Sunder. Bull. Soc. Ind. Mulhouse, 1921, **87**, 343-347. Pli Cacheté, No.2,096.

The author proposes to replace the greater part of the organic acids (citric or tartaric) employed in the usual sodium chlorate and potassium ferrocyanide pastes by boric acid. In this way there is less danger that the fabric and machinery will be attacked. If ammonia is added to the extent of about one-quarter of that required to neutralise the boric acid, the formation of oxycellulose is reduced to a minimum. Formulæ for the preparation of the discharging pastes are given. —J. C. W.

Direct Colours Fast to Light. G. Emmons. Silk, N.Y., 1922, **15**, 57.

Certain direct and acid dyes which are believed to be fast to light are mentioned and some details given on the solution of dyes and their application. —F. G. P.

Basic Dye Discharge. J. Pokorny. Bull. Soc. Ind. Mulhouse, 1921, **87**, 572, from Pli cacheté, 2,200 of 1913.

The author shows that certain basic colours which are not discharged by hydrosulphite are easily discharged by means of concentrated hydrosulphite-NF, if leucotrope-O (B.A.S.F.) is added to the printing colour. The goods after printing are steamed for 4 to 6 mins., washed, and soaped. —J. C. W.

Dyeing Cross-Wound Spools. Textilberichte, 1922, **3**, 116.

A device for facilitating the dyeing of cross-wound spools is described. The spools are wound on a spool machine with a smooth wooden shaft instead of on perforated paper tubes. The spools are transferred to a long nickelin tube of slightly smaller diameter which holds three or four spools of ordinary size. These metal tubes are provided with flanges on which the spools rest and fit into a vertical stand. Above the top spool is a circular cover which can be adjusted so as to press the spools lightly together. After dyeing the spools are transferred to wooden tubes of the same diameter as the nickelin tube. —J. C. W.

Substantive Cotton Dye: Salt Effect. R. Auerbach. Kolloid-Zeits., 1922, **30**, 166-168.

The results of an investigation on the influence of different salts in the dyeing of cotton with substantive dyes confirm previous experience that an optimum salt concentration exists. Further, there is a close relationship between the influence of the salt in the dyeing and its molar precipitating power. With increasing precipitating power the optimum concentration of a salt is lower. The maximum quantity of dyestuff taken up by the fibre decreases with increasing precipitating power of the salt. —J. C. W.

Dyeing of Worsted Fabrics. L. J. Matos. Text. World, 1922, **61**, 23-24.

Silk and cotton effect threads in worsted are sometimes "registered" to prevent absorption of dye or else a colour is used which has no affinity. A weak solution of ammonium oxalate is used to clear stained silk threads. Faced goods should be crabbed and folds and laps particularly avoided. —F. G. P.

Modern Dyeing Methods. A. G. Perkin Chem. Trade Jl., 1922, **70**, 260.

A report of Prof. Perkin's second lecture on "Dyeing: Ancient and Modern," given at the Royal Institute. The lecturer traced the history of the decline in the use of natural dyes, the main blow to which was caused by the discovery of the acid mordant colouring matters. The most important recent advance in tinctorial chemistry has been the discovery of new vat dyes of the indigo and also of the anthraquinone series. The superiority of indigo as regards fastness has been eclipsed by such vat dyes as hydron blue, etc., which are in demand for dyeing casement cloth, blouses, shirtings and handkerchiefs, not only because of their fastness but also as they withstand bleach. —F. C. W.

Dyes; Testing——. See Section 6.

Permeability of Dead Membrane. See Section 6.

Dyes; Fluorescence of——. See Section 6.

Alkali Test Paper; Preparation of——. See Section 6.

Fastness of Dyes; A Bibliography of Literature on the——. See Section 6.

(J)—PRINTING.

Surface Printing by Rollers in the Cotton Industry. A. Wilcock. Jl. Roy. Soc. Arts, 1922, **70**, 260-269.

The various processes of pattern printing for cotton cretonne, cotton dress material, and wallpapers are compared. Surface printing is a process in which the design is raised above the roller instead of being engraved intaglio fashion into the polished surface of a copper roller. The chief qualities of the surface printing process as compared with those for copper roller printing are in the softness of outline, general colour tone, and the tendency of the colour to "bleed" or run, thus giving a more liquid aspect to the pattern effect on the cloth, the finished print being very nearly the same as the more expensive hand block print. Other features distinguish designs printed by the surface process: for instance, there are no superposed colours as in the block print; a certain streaky effect is shown on the reverse of the print; a "mealy" quality is obtained in half tones of the deeper colours; and there is a general tendency to a lower colour tone than is produced by other printing processes. The method of transferring the original sketch design on to the rollers, the use of half tones and colours, the preparation and impress of the pattern, the finishing of the cloth and other details are described. In the discussion the preparation of designs for different processes and the texture of cloth suitable for colour printing are dealt with. —A. E. G. B.

(K)—FINISHING.

Finishing Cotton Cloths: Silk-Like Finish. Textiles, 1922, **20**, 19.

A silky lustre is produced by means of a crimping roller, cut spirally to press the weft alternately in deep and shallow grooves. —F. G. P.

Application of Photography to Textile Research. See Section 6.

PATENTS.

Finishing Fabrics. D.R. Cotton Mills, Ltd., London, and T. Andrew, Rochdale. E.P.173,572, Jan. 6, 1922. (Appl. No. 25,666/20.)

The selvages of canvas and similar fabrics are broken up or destroyed by removing certain of the warp threads and simultaneously combing out the ends of the weft threads associated with these warp threads. As the fabric is passing through the machine, the selvage is acted upon at its edge by a series of revolving rollers or discs having saw-like teeth, certain of which penetrate the selvage to a distance of one or two warp threads, while others comb out the ends of the associated weft threads. The apparatus may be made with two sets of discs to operate on both selvages simultaneously. —T. W.

Winding Webs. E. C. R. Marks, London. (Cameron Machine Co., Brooklyn, New York, U.S.A.) E.P.173,589, Dec. 29, 1921. (Appl. No. 27,685/20.)

In rewinding a web into a coil under tension transverse wrinkles in the web are nullified and interweaving of adjacent sections of a slit web is prevented by causing it to lap over a considerable portion of the surface of a drum provided with grooves extending substantially lengthwise of the axis. Circumferential non-helical grooves may also be provided in the drum, or in a separate roller, for producing in the web temporary minute longitudinal indulations, or a grooved plate may be provided for this purpose. —T. W.

Cracked Glazing Finish on Cloth. Juhellé de Mortilly. F.P.515,863. Appl. 21/5/20.

The cloth, printed or decorated, is varnished with a mastic varnish or fat varnish, dried, and a solution of sodium silicate spread over. After drying, a superficial cracked glazing appears. The silicate can be coloured if desired. The silicate layer is finally treated with a fixing varnish. —Bur. Text.

Carbonizing Woollen Rags, etc. V. Piana, Turin, Italy. E.P.172,851, Dec. 22, 1921. (Appl. No. 32,075/20.)

The apparatus has a thin-walled closed chamber surrounded by hot gases and provided with devices for feeding, conveying and discharging the material continuously, gaseous hydrochloric acid being introduced into one end of the chamber and discharged at the other. —T. W.

Bleaching Apparatus. A. Rangeley and A. Chidlow, both of Moston, Manchester. E.P.174,499, 30/1/22.

A wagon or truck wherein fabric can be plaited or cuttled horizontally and subsequently subjected to treatment with bleaching liquid, etc., in a bleaching kier, etc., whilst the folds are in an upright or vertical position, comprises a body part mounted on trunnions on a pedestal, etc., and having a fixed side and a removable side.

Improvements in the *Production* of Pattern Effects in Cotton and other Vegetable Fibres and also in Silk. R. S. Willows, F. T. Pollitt and T. Leach. E.P.171,806, 1/12/21.

A process is described for subjecting cotton cloth to ordinary embossing processes and obtaining thereby pattern effects which are resistant to the action of water and can be laundered, dyed, or printed without damage. A cotton or silk fabric containing between 7 and 15% of its weight of water is embossed with a hot roller or plate bearing a pattern in relief. It is then dyed, and may be finished either by calendering, embossing, printing, mercerising, schreinering, or raising. Dyeing may be replaced by parchmentising or mercerising, but after embossing it is essential that the fabric is treated with a reagent which produces a differential effect on the embossed and unembossed portions so that a pattern results. —J. C. W.

Washing Rags, etc. A. Spedding, Dewsbury. E.P.173,696, 12/1/22.

Machine in form of tank with perforated floor and with beaters carrying pivoted saddle-shaped frames to push the rags forward from one to the other. The tank has an inclined shoot at front and belt conveyor at rear whereby the rags, etc., are passed to squeezing rollers. Washing liquor is circulated by a water-wheel.

Cutting Fabric Strips. A. C. Bunker, Montclair, New Jersey, U.S.A. E.P. 173,592, Dec. 30, 1921. Appl. No. 27,781/20.)

The apparatus comprises a fixed drum on which the fabric tube is carried and from which it is drawn by a motor-driven roll continuously rotating round the drum. —T. W.

Printing on Edges of Fabrics, etc. F. Waite, Otley. E.P.174,456, 30/1/22.

Relates to apparatus for printing on edge or two edges of woven or other fabrics, to be used in conjunction with stentering or like machines.

Improvements in the Treatment of Fibres, Fibrous Materials and Fabrics with Liquids. M. Freiberger. E.P.146,225, 28/10/21.

In order to increase the wetting and penetrative properties of the aqueous solutions used in the cleaning, degreasing, scouring, bleaching, dyeing, etc., of textile materials, 0·5—2·0 grms. of pyridine or quinoline, or other heterocyclic base having the same wetting properties, are added to each litre of the solution employed. The substances mentioned, or their salts and simple derivatives, may also be added to liquids containing alcohol, carbon tetrachloride, or carbon disulphide. —J. C. W.

Process for Protecting Wool, etc., from Moth. W. Carpmael (from Farbenfabriken vorm. F. Bayer and Co.). E.P.173,536, 28/12/21.

Woollens, furs and hair may be permanently protected from moth by immersing the material in a 3% bath of colloidal tungstic acid to which sodium sulphate and sulphuric acid are added. The treatment may be applied prior to, during, or after dyeing. —J. C. W.

Warp Dyeing Machine. Walter F. Haskell, Portland, Me. U.S.P.1,402,765, 10/1/22. Appl. 11/10/18. Renewed 16/6/21.

Comprises a tank having a series of transverse partitions arranged to form a continuous passage for dye liquor, guide rolls journalled in line with said partitions for retaining the warp strand in said passage, and means for supplying liquor to the inlet of the passage. —T. W.

Method of Boring Embroidery Fabric. Robert Zohn (by Alfred Rietzsch, administrator, Plauen, Germany, Assr. to Alien Property Custodian). U.S.P. 1,403,221, 10/1/22. Orig. Appl. 9/7/12. Divided and Date of Pres. Appl. 5/3/15.

Consists in piercing the borers through the fabric and simultaneously projecting the stitching needles through the fabric so as to engage the latter with their points only and removing the said needles from the fabric preceding the moment the latter is displaced for boring a new series of holes. —T. W.

5.—LAUNDERING AND DRY-CLEANING.

Ink Stains; Removal of——. Rev. mens. Blanchissage, 1922, **17**, 3, 6.

Different inks vary considerably in composition, and the treatment applied for the removal of ink stains must be varied accordingly. A large number of recipes are given for the removal of (1) black ink, (2) red, violet, and blue ink, (3) marking ink, (4) India ink. —J. C. W.

6.—ANALYSIS, TESTING, GRADING, AND DEFECTS.

Cotton: Best Regain Conditions. Text. World, 1922, **61**, 1,541.

A chart is given showing what the moisture content of cotton should be in different stages of the opening processes, spinning, weaving and finishing. It is shown that most of the moisture possessed by the raw cotton is lost in the opening process. —J. C. W.

Standardized Tests for Colour Fastness as Prescribed by German Textile Commission. Colour Trade Jl., 1922, **10**, 92-95.

The tests include the following, full details being given in the text:—Washing and boiling test for fastness of coloured cottons; washing tests for fastness of coloured wools; rinsing tests in cold water for coloured cotton and wool; rubbing test for cotton and wool; ironing tests; testing fastness of dyed cotton and wools with sulphur; perspiration test for dyed cotton and wool; dust test for fastness of colour; acid boiling test for fastness of dyed cotton; acid test for fastness of dyed wool; acid and chlorine tests for dyed cotton; mercerised test for fastness of dyed cotton; bleaching and fulling tests for dyed wools; carbonising, decatising and salt-water tests for fastness of coloured wool; test for fastness of colours to light. —L. M. S.

Copper Catalyst. J. Piccard. Helv. Chim. Acta, 1922, **5**, 147-148.

Granulated zinc and finely powdered potassium or sodium dichromate are introduced into a round-bottomed flask, and concentrated hydrochloric acid is added slowly. The reaction is very vigorous. The hydrogen evolved protects the solution of chromous chloride from the air. The liquid is filtered through glass wool into a flask filled with carbon dioxide. Meanwhile, a solution of copper sulphate in ice-cold water is prepared and added to the chromous chloride solution with constant stirring. The precipitated copper is washed with water, filtered, and washed with alcohol and finally with benzene. Comparative tests have been made and show that this powder is superior to the "Naturkupfer C" and "Kupferbronce" prepared by Kahlbaum for catalytic purposes. —J. C. W.

Gelation: Cellulose Acetate. E. Knoevenagel. Kolloidchem. Beihefte, 1921, **13**, 242-261.

The swelling of cellulose acetate in the following binary liquid mixtures was measured at room temperature:—Benzene-alcohol, nitrobenzene-alcohol, and carbon tetrachloride-alcohol. The surface tension of these liquids of known composition was determined simultaneously. The degree of swelling in the pure liquids decreases in the following order:—Nitrobenzene, benzene, alcohol, carbon tetrachloride. The surface tension of the pure liquids decreases in the following order:—Nitrobenzene, benzene, carbon tetrachloride, alcohol. In the binary liquids, of which alcohol was a constant component, the alcohol lowered the surface tension in all cases. The relationship between the lowering of surface tension and the degree of swelling in binary liquid mixtures was studied. The stronger the capillary influence of the alcohol the greater the increase in the degree of swelling. The continued increase of the degree of swelling, however, has an effect on the swelling influence of the alcohol in relation to the stronger swelling component so that an optimum swelling power of binary liquid mixtures is attained. —J. C. W.

Bleached Fabric; Yellowing of——. W. B. Nanson. Chem. Abs. (from Text. Amer., 1921, **34**, 12-14), 1922, **16**, 650.

The yellowing of bleached canvas may be due to the effect of heat or time on (*a*) oxycellulose, (*b*) chloramines formed by the action of chlorine on the albuminoids of imperfectly scoured cotton, or (*c*) the chloramines accumulated in old bleaching liquors. —J. C. W.

Gelation: Swelling and Internal Friction in a Mixture of Cellulose Acetate and Nitrobenzene and Alcohol. E. Knovenagel. Kolloidchem. Beihefte, 1921, **13**, 262-271.

The swelling of cellulose acetate in a mixture of nitrobenzene and alcohol was measured and the relation between swelling and internal friction was studied. The ratio of the viscosities of two equally concentrated cellulose acetate solutions in different binary mixtures of nitrobenzene and alcohol is the same for all concentrations of cellulose acetate. In like binary mixtures the viscosity increases approximately proportionally to the logarithm of the internal friction with increasing cellulose acetate content. —J. C. W.

Microscopic Section; Mounting——. G. H. Needham. Science, 1922, **55**, 72-73.

In order to protect sections from mechanical injury, the author recommends the use of Canada balsam which has been heated on a water bath, until it becomes hard but not brittle, instead of the natural balsam. —J. C. W.

Dyes; Testing——. W. E. Mathewson. Jl. Assoc. Off. Agric. Chem., 1921, **5**, 196-218.

A summary is given of approved methods for the following estimations in the analysis of dyes:—Moisture; total matter insoluble in water; inorganic or non-volatile matter insoluble in water; total matter soluble in water; matter insoluble in carbon tetrachloride; sodium chloride; sodium sulphate; sulphated ash; heavy metals; calcium; arsenic by direct precipitation; arsenic after treatment with nitric acid; total arsenic; sulphur; nitrogen; total halogens; total iodine; sodium iodide; ether extractives; dye by titration with (1) titanium trichloride; (2) potassium permanganate; dye by colorimetric comparison; dye by spectrophotometer; lower sulphonated dyes; melting point; Martius Yellow in Naphthol Yellow S; boiling point of cumidine from Ponceau 3 R; Orange II. in Orange I.; Iodeosine G in Erythrosine; isomeric and similar dyes in Amaranth; sodium chloride in dyes or mixtures containing more than 25% of this substance; sucrose in dye mixtures; sodium carbonate in Erythrosine. —J. C. W.

Optical Pyrometer. E. L. Nichols. Science, 1922, **55**, 157-159.

The method of application of an optical pyrometer to measure the brightness of various fluorescent substances is described. The instrument consists of a telescope of short focus, low power and relatively large aperture, having a tungsten lamp in the focal plane. The filament of this lamp is superimposed upon the image of the experimental surface. With a screen in the eye piece so selected as to give a fair colour match with a minimum of adsorption it is easy to adjust the current until the filament merges in the surface with which it is to be compared. The lamp may be compared for temperature or directly for brightness using an illuminated matte surface subject to known fluxes of light. —J. C. W.

Paraffin-Wax Sections; Preparation of—. S. W. Geiser. Science, 1922, **55**, 212.

A simple method of dealing with electrified microsections is described. The device is adapted to any of the common types of rotary microtomes for the cutting of serial sections. It consists of a thin blade of celluloid, which is screwed flat against the section knife by means of the knife-holding screws of the carriage. A long, narrow strip of thin, tough paper is passed up between the celluloid blade and the microtome knife. After the paraffin block has been trimmed and adjusted to the knife the sections are cut, and as each one is cut it is attracted and held by the paper strip, which is pulled along with the fingers to produce a series. When the strip is nearly filled it is fastened to the table or board to prevent its curling and another strip is substituted.—J. C. W.

Alkali Test Paper; Preparation of——. H. V. Bettley-Cooke. Chem. Abstr. (from Chem. Eng. Mining Rev., 1921, **14**, 30), 1922, **16**, 214.

To increase the fastness of direct dyes on cotton, cresol was tried as a developing agent. Cotton dyed with 2% primuline in the usual way, rinsed, and treated with a solution containing 2% sodium nitrite and 6% hydrochloric acid, rinsed and placed in a solution containing 3% of cresol dissolved in 1% caustic soda, assumes an orange colour. This orange-yellow dyestuff is extremely sensitive to alkalies, and is changed to a distinct red. The percentages given are based on the weight of the cloth. By using blotting paper instead of cotton cloth a sensitive test paper may be prepared. —J. C. W.

Paper Pulp; Hydration of——. A. MacKay. Paper, 1921, **29**, 7-10 (Dec.).

All grades of raw material, including hull fibre, linters, rags, rope, hemp and flax, have been subjected to chemical hydration and the results of these tests, many of which were conducted on a commercial scale, are presented. Control of hydration is effected by forming a colloidal solution of cellulose and determining its viscosity. In general, chemical hydration results in a decrease in lignone, ash and wax content, a slight increase in copper number, little fibre loss and an increase in strength of the finished sheet from hydrated stock compared with unhydrated stock. The investigation on wood pulp is not yet complete. —J. C. W.

Cellulose Acetate from Wood. E. Hägglund, N. Löfman and E. Färber. Cellulosechemie, 1922, **3**, 14-19.

The preparation of cellulose acetate from pine wood, sulphite cellulose and filter paper has been studied. The order in which the acetylating agents and the catalyst are added and the different preliminary treatment to which the cellulose is subjected were found to have an important effect on the rate of acetylation. For example, if the cellulose is boiled with acetic acid and acetic anhydride, cooled, and sodium ethyl sulphate added as catalyst the time required for the acetylation is considerably increased. The addition of a trace of water after boiling the cellulose, however, decreases the time of reaction. Boiling the cellulose with chloroform, acetylene tetrachloride, or alcohol, which does not alter its copper number, before acetylating in the presence of sodium hydrogen sulphate as catalyst also increases the time required for the acetylation. On the other hand, if the cellulose is treated with acetic acid and the catalyst and acetic anhydride added after several hours, the time of acetylation is shortened. Details are given of the most rapid method so far devised. —J. C. W.

Bacteria: Fumigation. D. I. Macht and W. M. Kunkel. Abstr. Bacteriology (from Proc. Soc. Exper. Biol. and Med., 1920-21, **18**, 68-70), 1921, **5**, 398.

A number of gums, spices and other aromatic substances of a similar nature were subjected to destructive distillation, and the antiseptic effects of the fumes on bacterial cultures were studied. The tests were made with *B. coli* and *B. pyocyaneus*, and it was found that the fumes tend to exert an antiseptic action on these bacteria. The fumes produced by destruction of various woods and cotton gave similar results, but pure cellulose was not antiseptic in this respect. —J. C. W.

Cellulose Nitrate. H. N. Holmes and D. H. Cameron. Jl. Amer. Chem. Soc., 1922, **44**, 66-70.

Cellulose nitrate serves as an excellent emulsifying agent in dispersing water, or glycerol, throughout amyl acetate or other " solvents " for the nitrate. Visible concentration films of cellulose nitrate were observed round large drops of water " emulsified " in amyl acetate-benzene. An increase in concentration of cellulose nitrate at the acetone-glycerol interface was studied quantitatively. The properties of an ideal emulsifying film are discussed. —J. C. W.

Dyes; Fluorescence of——. S. I. Vavilor. Phil. Mag., 1922, **43**, 307-320.

The author describes a study of the connection between the intensity of the fluorescence of dyes and the wave-length of the exciting light. Aqueous solutions of fluorescein, eosin-S and rhodamine-B were selected for the investigation, and the conclusion is drawn that the specific fluorescence of the dyes is independent of wave length within their band of absorption, or, in other words, the absorption curves are physically simple. —J. C. W.

Cellulose: Fermentation. J. Groenewege. Abst. Bact. (from Bull. du Jardin. Botan. de Buitenzorg., 1920, Ser. IV., **2**, 261-314), 1921, **8**, 308.

The author has made a detailed study of the decomposition of cellulose in the soil by aerobic bacteria. By a symbiotic action of two groups of bacteria, a rapid decomposition of cellulose was accompanied by a rapid denitrification: one group decomposed the cellulose, while the other reduced the nitrate. This reduction was made possible by the products of the decomposition of cellulose by the first group. By cultivating the organisms on solid media, the author obtained pure cultures of *B. opalescens* and *B. viscosum* belonging to the first group and *B. cellaresolvens*, α, β and γ belonging to the second group of bacteria. A symbiotic relationship for cellulose decomposition and denitrification existed between representatives of each of the two groups. —J. C. W.

Cellulose Acetate: Gelation. E. Knoevenagel. Kolloidchem, Beihefte, 1921, **13,** 193-212.

Cellulose acetate does not swell in pure water or absolute alcohol, but swells greatly in mixtures of water with alcohol or other organic liquids. Two methods are described by which the degree of swelling of the colloid was measured. "Unswollen" cellulose acetate is coloured only very slowly in an aqueous dye bath at 25°; with slightly swollen cellulose acetate the maximum colour is reached in several months, and with fully swollen cellulose acetate the limiting value of the colour under the same conditions is attained in a few minutes. Raising the temperature hastens these colour processes. The significance of the relation between speed of colouration and degree of swelling for the dyeing of textile fibres and staining in microscope work is shown. Unswollen cellulose acetate is very difficultly saponifiable, but swollen cellulose acetate is completely saponified by 0·5N potassium hydroxide in a few hours at room temperature, and the velocity of the reaction increases with the degree of swelling. A convenient and accurate method of acetyl determination is based on the behaviour of swollen cellulose acetate towards dilute aqueous alkalis at room temperature. —J. C. W.

Gas Fastness of Dyeings and the Detection of Formaldehyde. P. Heermann. Textilberichte, 1922, **3,** 101.

Reference is made to Ristenpart's article on testing for formaldehyde (see This *Jl.* Abs., 1922, **13,** 71), in which the fuchsin-sulphurous acid test is regarded as unsuitable. It was found that pure paper and fibres show no immediate red colouration, but after standing from one day to a week a more or less intense reddish blue colour develops. Many raw papers and pastes which were free from formaldehyde produced a distinct red colouration in half an hour (distinct from the faint rose red colour due to oxidation). This was found to be due to the lignin present. The development of colour due to formaldehyde takes place at once, or with slow wetting adhesives in at the most a few minutes. The author therefore recommends testing by introducing the sample into a porcelain dish, with the reagent, and observing whether immediate colouration is produced. The Cohn method was also investigated. It was found that the best results were obtained by dissolving the resorcin in 100% sulphuric acid and using this as the reagent. By spotting on to the reagent contained in a porcelain dish and observing the red ring produced a few drops are sufficient for the test. For control or quantitative work the sample can be distilled, after hydrolysis with dilute acid, and the formaldehyde estimated by the fuchsin method, colorimetrically or by the reduction of alkaline silver nitrate. —E. B. A.

Fats; Staining of——. J. L. Smith and T. Rettie. Abstr. Bacteriology, 1921, **5,** 487-488.

It is found that aldehydes act as mordants in the staining of fats and lipins. Two methods of application are described in which formaldehyde and acetaldehyde respectively are employed. The staining is not so intense or regular in the case of a saturated solution of benzaldehyde. No staining of fat is seen after treatment with furfuraldehyde. Pure aldehyde solutions do not mordant, the presence of a polymerised aldehyde, which need not be derived from the same aldehyde, being necessary. The reaction takes place at room temperature, but much more rapidly at 37°C. Direct sunlight also accelerates the reaction. —J. C. W.

Lignin; Staining——. C. van Zijp. Chem. Abstr. (from Pharm. Weekblad, 1921, **58,** 1,539—1,542), 1922, **16,** 541.

Benzidine hydrochloride stains ligneous material orange. Although the colour is more intense with a neutral solution, the presence of free hydrochloric acid is desirable, particularly in the presence of iron or tannin. The reagent is prepared by dissolving 0·2 grms. of benzidine in 19 ccs. of water and adding 1 cc. of 25% hydrochloric acid. It does not deteriorate if kept in an amber bottle. For staining sections containing much tannin, the latter should be removed by washing with alcohol containing 1% hydrochloric acid. After staining with benzidine, starch may be indentified in the same specimen by means of iodine in potassium iodide solution. This treatment also intensifies the orange stain of the lignin. A drop of glycerol, with or without phenol, may be used as a preservative, or the stained section may be washed in alcohol and xylene, and mounted in Canada balsam. This reagent for lignin is more stable than aniline salts, and, because of the smaller amount of hydrochloric acid required, is less apt to corrode the microscope.

—J. C. W.

Gelation: Cellulose Acetate. E. Knoevenagel. Kolloidchem. Beihefte, 1921, **13,** 233-241.

Using aniline, phenol, or tartaric acid esters in solutions of low concentration the two-phase system aqueous solution, cellulose acetate-hydrogel, was studied. Various kinds of cellulose acetate were employed, and the systems were allowed to stand for 24 hrs. It was then found that they obeyed Henry's distribution law. This indicates that solution processes take place in both phases and that there is no surface adsorption by the cellulose acetate. Experiments with diethyl tartrate show that unswollen cellulose acetate cannot take up the ester from aqueous solution as rapidly as previously swollen cellulose acetate. —J. C. W.

"Samson" Temperature Regulator. Science Abstr. (from Engineering, 1921, **112**, 307), 1922, **25**, 32.

The "Samson" automatic temperature regulator operates by the expansion and contraction of a liquid highly sensitive to temperature variations, the pressure due to the expansion of the liquid being applied to a special form of frictionless piston. The thermostat is connected by a tube to the controller which operates a valve, thus opening or closing the steam, hot water, or other connection. The parts are completely filled with the operating liquid and are hermetically sealed. Inside the controller, over the valve, there is a long piston constructed of seamless, spirally-corrugated tubing of great elasticity and resiliency, and made from a copper alloy. One end of the piston is fastened to the casing, whilst its top end is fastened to a rod which, passing down through the interior of the piston, operates the valve. In the thermostat there is a similar piston, the motion of which is controlled by a spring. —J. C. W.

Textile Materials; Inspection of——. J. Smeaton. Text. Merc., 1922, **66**, 297-299.

In a lecture on the inspection of textile materials the author emphasises the importance of exact specifications and tolerances. The specifications should cover the counts of yarn in yarn contracts, the counts of yarn in cloth, the sizing, loading and finishing materials which may be present in, or must be excluded from, the finished cloth, the number of ends and picks per inch, and the width, weight and strength of the cloth. In the case of the strength, the type of testing machine to be used, the size of test specimens and the moisture content should be indicated. Shrinkage limits, fastness of dye and waterproof properties should be specified. —J. C. W.

Cellulose. R. Sieber. Zellstoff u. Papier, 1922, **2**, 27-29.

It is shown that the relation between the chlorine figure of cellulose and its lignin content and "bleachability" is such that both these properties can be predicted if the chlorine figure is determined. In order to make it easier to ascertain the mutual relationships, the experimental results obtained are represented graphically. This diagram is intended to serve as a basis for further work on the classification of sulphite cellulose. —J. C. W.

Celluloses; The Effect of Water and of certain Organic Salts upon——. J. Huebner and F. Kaye. Jl. Soc. Chem. Ind., 1922, **41**, 94T.

Highly purified cotton or other cellulose when exposed to the action of water at 35°C. for a considerable time yield soluble aldehydic compound. —F. C. W.

Testing of Tops and Fibre Measurement: A Special Projection Apparatus. W. Davis. Wool Rec., 1922, **21**, 752-755.

A description is given of a projection apparatus made by a Manchester firm to the design of the National Physics Laboratory, which has been used in wool testing. It is stated that this apparatus makes it possible to draw out a series of standard fibre thicknesses which can be laid down as representing the whole range of wool qualities and determining the exact limits of difference for any given quality number. —J. C. W.

Spectrophotograph: Exposure. W. Gerlach and E. Koch. Ber., 1922, **55**, 695.

A method for obtaining flashlight exposures in spectrophotography is described, in which the source of light is provided by a fine iron wire connected in circuit with a large battery of Leyden jars charged by means of a small influence machine. On discharging the jars the wire gives a dazzling pale light and is pulverised. In this way the intensity of the light is maintained constant throughout a series of observations. —J. C. W.

Viscosimeter. R. v. Dallwitz-Wegner. Zeits. Tech. Physik., 1922, **3**, 24-25.

The instrument was designed for measuring the absolute viscosity of lubricating oils. The principle is that of the Poisseuille capillary, but the viscosity can be measured very simply at any desired temperature. A small vessel containing the oil and heated by a Bunsen burner is connected with a cylinder carrying a manometer. This cylinder is connected by means of a three-way tap with a reservoir. Using a foot-pump, the pressure in the reservoir is increased, and by manipulating the three-way tap the pressure in the cylinder can be adjusted so that the jet of oil forced through the capillary just reaches a height marked on the apparatus. The tap is then adjusted so that communication between the reservoir and cylinder is cut off and the pressure in the latter, and therefore in the oil vessel, falls to atmospheric value. The pointer of the manometer falls to zero, but a second pointer which it carries with it remains at the value at which the oil reached the given height. This pressure is directly proportional to the absolute viscosity of the oil, and the apparatus is so arranged that the latter can be read off directly. Illustrations are given.—J. C. W.

International Testing House in Yokohama. D. E. Douty. Silk, N.Y., 1922, **15**, 68.

It is proposed to add to the facilities afforded by the Japanese Government Silk Testing Department by means of an International (American) Testing House to be run by the United States Testing Co. —F. G. P.

Plant Colloids. XI. Electrodisintegration of Starch Solutions. M. Samec and A. Mayer. Kolloidchem. Beihefte, 1921, **13**, 272-288.

By electrolysis of starch solutions, a retrogression solution of amyloses giving a blue colour with iodine (amyloamyloses), an optical rotation of $\alpha_D = 189°$ and an average molecular weight about 80,000 was obtained. This fraction is about 17% of the total starch. It is almost electrically neutral. The amylopectin, freed from amyloamyloses gives a violet-red colour with iodine, has a conductivity of $8{\cdot}3 \times 10^{-5}$ and an H-ion concentration of $2{\cdot}4 \times 10^{-4}$N. Its mean molecular weight is 113,000. No retrogression erythroamyloses are obtained from amylopectin by heating with water under pressure in neutral solution. In acidified solution the amylopectin is not only saponified but is disintegrated and yields, within 6 hrs., up to 80% dialysable matter. The colloid residue has a molecular weight of 57,000. It gives a wine colour with iodine and has $\alpha_D =$ 195-196°. The presence of erythroamyloses in the solution can be detected colorimetrically or by means of an excess of amyloamyloses. The ratio of the constituents in the iodine-amyloamylose complex appears to be in accordance with the formula $(C_6H_{10}O_5)_2I$. The erythroamyloses appear to take up more iodine. The term soluble starch is justly applied to the erythroamyloses. The " elementary molecule " of starch may have a molecular weight under 2,000.
—J. C. W.

Permeability of Dead Membrane. A. Bethe. Biochem. Zeits., 1922, **127**, 18-33.

The diffusion of acid dyestuffs through parchment, compared with that of water, is accelerated in acid solution and retarded in alkaline solution. With basic dyestuffs the conditions are reversed. If an acid dye diffuses from acid solution through parchment into an albumen solution, the dyestuff concentrates in the sol. In the case of an acid dye in alkaline solution, negative adsorption is observed. With basic dyes the conditions are reversed. The process is reversible. Colour processes in the living cell are discussed on the basis of these experiments, and are found to be in agreement with the hypothesis that the H-ion concentration plays an important part in them. —J. C. W.

Filter Paper; The Penetrability of——. R. C. Griffin and H. C. Parish. Jl. Ind. Eng. Chem., 1922, **14**, 199-200.

The common methods of testing the penetrability of filter paper are discussed and a new penetrability tester, which has been made as nearly automatic as possible and gives consistent results, is described. The effect of temperature and time of filtration on the speed of filtration of distilled water is discussed. Comparative penetrability figures are given for five representative grades of quantitative papers.
—J. C. W.

Sulphate Cellulose. J. Boija. Chem. Abstr. (from Svensk Pappers Tid., 1921, **24**, 298-299), 1922, **16**, 644.

Six curves, representing determinations on lightly bleached sulphate cellulose from the Nensjoe plant, show the percentage of water in the pulp at each set of rolls in the drying machine, the drop in the water content as cellulose is dried at 105°C., the absorption of water by absolutely dry cellulose at 15°, the comparison of the actual with the determined water content, and the water content of cellulose at varying amounts of water in the air. The water content of cellulose is about 0·7% higher than tests usually show.—J. C. W.

Cellulose; Alleged Adsorption of Alumina from Aluminium Sulphate Solutions by——. A. Tingle. Jl. Ind. Eng. Chem., 1922, **14**, 198-199.

Experiments are described which indicate that the supposed withdrawal of alumina from solutions of aluminium sulphate by cellulose is due to chemical precipitation by non-cellulose material present as an impurity. Ordinary analytical methods were adopted, and adsorption of alumina by cellulose of reasonable purity could be observed in such solutions whether basic or neutral. Methods of investigation which depend on attempts to separate aluminium salts from cellulose by repeated washing can only be employed when great caution is used as to the nature of the materials, and are quite untrustworthy in the case of basic solutions. —J. C. W.

Hygrometry; Discussion on——. Proc. Phys. Soc., 1922, **34**, i-xcv.

This discussion includes the following papers:—The Measurement of Atmospheric Humidity, Sir M. Shaw; The Theory of the Hair Hygrometer, F. J. W. Whipple; The Rationals of Glaisher's System of Hygrometry, F. J. W. Whipple; The Wet and Dry Bulb Hygrometer, S. Skinner; Note on Psychometry in a Wind Channel, R. A. W. Watt; The Tilting Hygrometer: A New Form of Absorption Hygrometer, H. G. Mayo and A. M. Tyndall; A Thermal Hygrometer, A. M. Tyndall and A. P. Chattock, based on the heat evolution that occurs when cotton, cellulose, etc., take up moisture—a thermo-couple is used for measuring the temperature rise. A general discussion on these papers follows and a Bibliography on Hygrometry by E. Griffiths.—E. A. F.

Titrations in Ethyl Alcohol as Solvent. Bishop, Kittredge and Hildebrand. Jl Amer. Chem. Soc., 1922, **44**, 135-140.

Hydrogen-electrode titration curves are given for a number of reactions in ethyl-alcohol, together with a table of indicators for use in such reactions. The possible applications of the data obtained are illustrated by the titration of a fatty acid in the presence of its glyceride.—F. C. W.

Lignin: Constitution. P. Klason. Ber., 1922, **55**, 448-456.

Describes further work on the derivatives of pine wood lignin with a view to elucidating its constitution. The following derivatives have been studied:—(1) The α- and β-naphthylamine salts of α-lignosulphonic acid ; (2) the β-naphthylamine salt of methylated α-lignosulphonic acid ; (3) the β-naphthylamine salt of the ammonia derivative of α-lignosulphonic acid ; (4) the β-naphthylamine salt of α-ligno-oximesulphonic acid ; (5) the condensation product between α-lignosulphonic acid and semi-carbazide ; (7) the acetylation products of the *B*-naphthylamine salts. Two structural formulæ for lignin are proposed, one of the flavone type containing a five-membered pyrone ring and the second containing a coumarone or furfurane ring. Both formulæ satisfy all known facts. α-Lignosulphonic acid is, as far as can be observed, optically inactive. The author presents evidence to show that he has obtained α-lignin with unchanged acrolein complex, and identical with the natural product as it occurs in wood. This acrolein complex is probably linked to the hemicellulose in the acetal form, and becomes free when the latter passes into solution. This lignin is, as far as can be detected, optically inactive. —J. C. W.

Hygrometers; Some Modified Forms of—. E. Griffiths. Proc. Phys. Soc., 1922, **34**, VIII.-XLIX.

Describes experiments made with the object of developing suitable apparatus for the measurement of humidity at low temperatures. The wet and dry bulb hygrometer, the dew-point apparatus and the hair hygrometer were so modified that they could be used in a low temperature room inaccessible to the observer. The following points are dealt with in some detail:—(1) Apparatus for obtaining variable humidity; (2) standard of reference in calibration work on hygrometers; (3) wet and dry bulb hygrometers of the ventilated type—determination of velocity of air stream past the wet bulb, tubular psychrometer, experiments below 0°C. with the ordinary form of Assmann psychrometer, low-temperature distant-reading psychrometer; (4) the dew-point hygrometer—temperature difference between the thermometer and silver surface, estimate of weight and thickness of dew deposit, industrial forms of dew-point apparatus; (5) the hair hygrometer—reliability over long intervals of time, behaviour when taken through a complete cycle of humidities, calibration at low temperatures, influence of change of temperature, accuracy of the engraved scale, relation between extension of hair and relative humidity, distant reading type; (6) thermal effect on cotton hygrometer—previous work on heating of cotton by water-vapour absorption, electrical resistance type; (7) the hot-wire type of hygrometer. —E. A. F.

Cellulose and Starch; Constitution of——. J. J. Lynst Zwikker. Rec. Trav. Chim., 1922, **41**, 49-53.

Space formulæ have been devised for starch and cellulose. In the case of starch, the figure is a truncated tetrahedron. At three of its angles a carbonyl group and two hydroxyl groups lie together. At the fourth angle three carbonyl groups lie together. The hexose chains form the edges of the tetrahedron. Cellulose is represented by a triangular prism. At four of its corners a carbonyl group and two hydroxyl groups lie together, at a fifth corner two carbonyl groups and one hydroxyl group, and at the sixth corner three carbonyl groups. The author points out how the properties of starch and cellulose can be explained by these formulæ. —J. C. W.

Cellulose and Starch: Constitution. J. J. Lijnst Zwikker. Rec. Trav. Chim., 1922, **41**, 152.

The author calls attention to an error in his previous communication. The formula given for starch leads to the constitution $C_{36}H_{66}O_{33}$ and gives with regard to $n(C_6H_{10}O_5)$ a difference of 2·3% in the carbon content and 6% in the glucose content. These differences are greater than those stated in the analysis. The formula given for cellulose is also incorrect. To bring these formulæ into agreement with $n(C_6H_{10}O_5)$ or $n(C_6H_{10}O_5) + H_2O$ elimination of water in several of the chains or between the chains must be postulated. The formula for starch then becomes 6 Glucose—3 H_2O and that of cellulose 9 Glucose—4 H_2O. —J. C. W.

Celluloses, Silk, and Wool; The Action of Iodine upon——. J. Huebner and J. N. Sinha. Jl. Soc. Chem. Ind., 1922, **41**, 93T.

It is found that on steam-distilling these substances with iodine and caustic potash, iodoform is obtained even after repeated treatments. Bromoform has been obtained in a similar way. Investigation is proceeding. It is expected that these results will affect the behaviour of certain dyestuffs. —F. G. P.

International Testing House at Shanghai. D. E. Douty. Silk, N.Y., 1922, **15**, 39.

Describes, with photographs, the work done and results obtained in testing silk from the reelers. It is hoped that the testing house will improve the quality of the silk and assist in obtaining uniformity in deliveries from each source. —F. G. P.

Application of Photography to Textile Research. E. D. Walen. Text. World, 1922, **61**, 652, 795, 797.

The author maintains that enlarged photographs are more useful than microphotographs and are especially adapted for studying the results of various processes, notably in the study of sized yarns and finished fabrics. —J. C. W.

Colour Research for Textiles; The Fundamentals of——. H. S. Busby. Text. World, 1922, **61**, 146.

An account is given of colour technique as applied to the textile industries and its use in facilitating standardisation, registration, and matching of colours. —J. C. W.

Kata-Thermometer. L. Hill, H. M. Vernon and D. Hargood-Ash. Proc. Roy. Soc., 1922, **93B**, 198-206.

The authors show that this instrument indicates a definite relation between the heat loss and the surrounding conditions. By means of certain equations it may be used as an anemometer for estimating wind velocities out of doors or the velocity of air currents indoors, as an aid in the study of ventilation. For the latter, it has a special value, for it estimates cooling effects of air currents whether unidirectional or eddying. —J. C. W.

Cellulose; The Quantitative Determination of the Fluorescent Powers (the Spectrofluorescometry) of——, Sugars and other Substances. S. J. Lewis. Jl. Soc. Dyers and Col., 1922, **38**, 68-76.

The author has now overcome certain experimental difficulties pointed out in the Interim Report (This *Jl.*, 1921, **12**, 406; *Jl. Soc. Dyers and Col.*, 1921, **37**, 201-4). In making quantitative comparisons with an arbitrary standard (Nos. 42 and 44 Whatman filter paper) the well-known principles of ordinary photometry and spectro-photometry are adopted. The method rests on the assumption that the fluorescent effect is proportional to the time of exposure of the plate. It was found that the sensitiveness of the plates to the fluorescent glow is in part at least dependent on climatic conditions. Most successful work was done with plates obtained in the early summer. Curves expressing fluorescent power as ordinates and wave length of light as abscissae were plotted for wool, silk, wood (pitchpine and mahogany), filter papers, bleached linen, grey linen, etc. The effect of industrial treatment on the fluorescent power was also examined. —F. C. W.

Preparation and Alkyl Interchange of Cellulose Esters: Cellulose Stearate and Laurate. A. Grün and F. Wittka. Z. angew. Chem., 1921, **34**, 645-648.

The esters are prepared by treatment of cellulose with the acid chlorides in the presence of pyridine. The mono-esters are white, fibrous masses scarcely different from cellulose in appearance except when examined under the microscope. They also differ in solubility in certain solvents and in their characteristic behaviour towards fat stains of the type of Sudan III. The authors have also investigated the alcoholysis of cellulose triacetate and cellulose stearate by ethyl and isoamyl alcohols, and the action of the ethyl esters of acetic, caprylic, lauric, and stearic acids on cellulose. —J. C. W.

Phosphorus; Estimation of——in Waters. D. Florentine. Chem. Abstr. (from Ann. chim. anal. chim. appl., 1921, **3**, 295-296), 1922, **16**, 601.

A modification of Denigè's method for the estimation of phosphate in waters is described. A few drops each of an acid solution of ammonium molybdate and a solution of stannous chloride are added to 10 ccs. of the water to be tested. In a few seconds a blue colour begins to develop, which gradually becomes more intense, reaching a maximum in 10 mins. The colour is compared with that produced in solutions containing known amounts of phosphate. A more permanent colour standard may be obtained by using a dyestuff such as indigo-carmine. —J. C. W.

Rosin Suspension; Properties of——. R. Sieber. Zellstoff u. Papier, 1921, **1**, 15-19, 65-69, 139-142 and 184-188.

The colloidal properties of a rosin suspension are discussed in their bearing on rosin sizing in the paper industry. The suspension is prepared by adding an alcoholic solution of colophonium to distilled water. The coagulation of the suspension by ferric chloride and aluminium sulphate is investigated, and graphs are drawn showing amount of precipitation against concentration of salt. The valency rule for different ions is found to hold. A discussion is given of the degree of dispersion of the system and of the temperature effect on stability. Animal glue is found to be a satisfactory protective colloid for this suspension. Adsorption of rosin by different "half stuffs," including cotton, is given. From a study of the coagulation of sodium resinate by aluminium sulphate and of the effects of organic solvents on the precipitate, the author comes to the conclusion that both true chemical action and colloidal phenomena are involved. A similar effect is found for calcium and magnesium salts. A table is given showing the effect of calcium chloride, calcium carbonate, magnesium chloride and magnesium bicarbonate on (1) neutral rosin suspension; (2) rosin suspension and 40% free rosin. —J. C. W.

Swelling of Gelatine in Aqueous Solutions of Organic Acids. A. Kuhn. Kolloidchem. Beihefte, 1921, **14**, 147-208.

An exhaustive investigation of the effect of aqueous solutions of different organic acids on the swelling of gelatine. —L. M. S.

Fastness of Dyes; A Bibliography of Literature on the——. W. J. Murray. Amer. Dyestuff Reporter, 1922, **10**, 123 and 160.

A list of journal articles on this subject is given dating from 1888 and also the names of some textbooks giving methods of testing dye fastness. —L. M. S.

Viscosity of Some Cellulose Acetate Solutions. G. Barr and L. L. Bircumshaw. Jl. Chem. Soc. (from Trans. Faraday Soc., 1921, **16**, Appendix, 72-75), 1922, **122**, Ai, 232.

The viscosity and density of 5% solutions of cellulose acetate have been determined in acetone and mixtures of acetone and water, benzene, and ethyl alcohol respectively. The second solvent was added in all concentrations up to the point where cellulose acetate was precipitated. The viscosity-concentration (of second solvent) curves are markedly different. Benzene causes a progressive increase in the viscosity with increase in the concentration, whereas water and alcohol give an initial rapid fall in viscosity, which in the case of water reaches a minimum and then rises fairly rapidly, but with alcohol remains fairly constant at the minimum value. —L. M. S.

Cellulose and Celloidin: Double Refraction. H. Ambronn. Chem. Abstr. (from Nachr. Ges. Wiss. Göttingen), 1921, **15**, 3,393-3,394.

The accidental double refraction of celloidin and the cellulose prepared from it is dependent upon the refractivity of the liquids with which these compounds are saturated. The value for the double refraction of celloidin may be positive, negative, and also zero, but in the case of cellulose the value is always positive and never zero. To explain the results there is assumed a combination of the double refraction of rods as proposed by Wiener with the proper double refraction of the rod-like particles. This latter has a negative sign in the case of celloidin and a positive sign in the case of cellulose. The author regards the phenomenon as a confirmation of Nägeli's theory.

—J. C. W.

Spectrochemical Reaction of Methylfurfuraldehyde and Hydroxymethylfurfuraldehyde Phloroglucides. T. Tadokoro. Jl. Chem. Soc. (from Jl. Coll. Agric. Hokkaido Imp. Univ., 1921, **10**, 52-56), 1922, **122**, Aii, 236-237.

The difference in the colour reactions of methylfurfuraldehyde and hydroxymethylfurfuraldehyde as phloroglucides may be observed by means of the ultra-violet spectroscope. The colour reaction when the two aldehydes are allowed to react with phloroglucinal and hydrochloric acid changes with the time and is complete in 5 mins. At a half to 2 mins. after the beginning of the reaction the two phloroglucides give almost the same absorption band in the visible spectrum (wave-lengths 4,200—5,000 and 4,100—5,000), but the methylfurfuraldehyde phloroglucide shows an absorption band in the ultra-violet at wave-lengths 2,400—3,800. Five mins. after the beginning of the reaction methylfurfuraldehyde phloroglucide gives an absorption at 4,300—4,800, whilst hydroxyfurfuraldehyde phloroglucide shows an absorption band at 5,000—5,500.

—J. C. W.

Cotton: Constituents. H. Grimm. Zellstoff u. Papier, 1921, **1**, 34.

Some figures are given of the percentage of water, ash, furfuraldehyde yield and pentosan in bleached and unbleached cotton, linen, and flax. The percentage of ethereal and of alcoholic extract and the acid and saponification numbers of the extract are also given. —J. C. W.

Cotton Hair; The Structure of the—and its Botanical Aspects. See This *Jl.* (Trans.), 1922, **13**, 99.

Research in Woollen and Worsted Industries. See This *Jl.* (Proc.), 1922, **13**, 68.

7.—BUILDING AND POWER.

(C)—POWER.

Mechanical Department of Mills; Advance in——. J. W. Easter. Textile World, 1922, **61**, 381.

The increase in the number of electrically driven mills in the last few years has been enormous, and more and more are being individually driven throughout. Motors have to be started and stopped by every mill-hand, and automatic starters operated by push buttons fixed in convenient places on the machine are coming into wide use. For connecting motors to machines, chain drives have given invaluable service, and one advantage is that the speed of the machine can be changed by changing the pinion. Manufacturers are now, however, trying to perfect a motor that will permit a limited speed variation by simply moving a lever on the control gear, and this would certainly find a wide application for direct coupling to machines. Inverse time element fuses are coming more into use for protecting small motors against injurious overload, while at the same time permitting heavy momentary loads to be carried. Conveying systems are being applied to save almost all manual handling of stock, and an example is given where cotton is blown through a pipe half a mile long.

—V. M.

(D)—LUBRICATION.

Lubricant. W. B. Hardy and I. Doubleday. Proc. Roy. Soc., 1922, **A.100**, 550-574.

The lubricating qualities of normal paraffins and their related acids and alcohols have been studied. Boundary lubrication only is considered, and attention is concentrated on (1) the quantity of lubricant present, (2) the composition of the solid surfaces, (3) the chemical constitution of the lubricant. Theoretical considerations are discussed. —J. C. W.

Paraffin Wax; Effect of——on the Properties of Mineral Oils. A. P. Bjerregaard. Jl. Ind. Eng. Chem., 1922, **14**, 215-217.

The effect of paraffin wax on the properties of mineral oils has been studied. The wax decreases the viscosity of the more viscous oils, but not of the less viscous ones. In solution in mineral lubricating oils it acts like a thinly fluid oil in its effect on the viscosity. Its addition to such an oil raises the freezing point according to a definite relationship dependent solely on the amount of paraffin wax present. A simple method of determining the amount of paraffin wax in waxy oils is indicated. Paraffin wax lowers the specific gravity of mineral lubricating oils. The graph showing this relationship is a straight line. Hence there is no change of total volume on dissolving paraffin wax in mineral lubricating oils. —J. C. W.

(F)—LIGHTING.

Artificial Daylight for the Textile Industry: A New Colour-Matching Unit. Text. Merc., 1922, **66**, 311.

The "Trutint" daylight lamp consists essentially of a Mazdalux reflector fitted with a special daylight glass screen and equipped with a Mazda gas-filled lamp. This screen produces an illumination which for practical purposes is identical with daylight from a north sky.—J. C. W.

(H)—HUMIDIFICATION.

Humidifying Cotton Yarns. L'Avenir Text., 1922, **4**, 248.

The harder the yarn is twisted, the greater is its tendency to curl. Warp yarns are the classes of yarns which almost invariably undergo this process; on the other hand, when weft yarns are strong and spun from short cotton it is advantageous to humidify them to prevent the yarn from curling during unwinding from the shuttle when weaving. Various methods are discussed:—(*a*) The old method of using steam under pressure in a boiler; (*b*) humidifying the yarn in damp cellars; (*c*) humidifying machines as made by several firms; (**d**) by soaking the bobbins by means of a hose pipe. Method (*c*) is claimed as the most effective and satisfactory, when water under pressure is used instead of steam. —A. H. M.

(I)—VENTILATION.

Kata-Thermometer. See Section 6.

8.—DESIGN.

Trade Marks, Patents and Designs Federation. See This *Jl.* (Proc.), 1922, **13**, 68.

Ornament and Colour; Application of——to Textile Fabrics. See Section 3G.

Surface Printing by Rollers in the Cotton Industry. See Section 4J.

9.—COMMERCE, ECONOMICS, LABOUR, ORGANISATION, COSTING, &c.

Vibration: New Study of Noise Effects. Times Trade Supp., 1922, **10**, 68.

It is suggested that an inquiry be made into the effects of vibration on workers in textile and other factories. The inquiry will naturally fall under two heads—vibration which is vibration from the beginning (*e.g.*, the shaking or trembling of a vehicle) and vibration which is noise in the first instance and becomes vibration owing to the interposition of floors, walls, or machines. —L. M. S.

Artificial Silk in Brazil. M/c Guardian Commercial, 1922, **4**, 469.

Artificial silk will shortly be manufactured in Brazil. Vegetable fibres found in Brazil are to be utilised for raw materials. —L. M. S.

Wool Statistics. Nat. Assocn. Wool Mfrs., Annual Wool Review, 1921.

In connection with wool consumption in the U.S.A., curves are given showing the total of grease, scoured, and pulled wools (domestic and foreign) for 1918-1921. Other statistics include:—Number of sheep in U.S.A. as on January 1, 1922, for 1911-1921; wool product of the U.S.A. for 1921 (quality, number of fleeces, average weight per fleece, etc., for each State); mohair production in U.S. for 1900-1921; wool imports and exports of U.S.A.; sheep and wool production of the United Kingdom, Australasia, New Zealand, Germany, France, Peru, S. Africa, China, Japan and the Argentine; number of sheep in the world and wool production of the world according to the latest available reports and estimates. —L. M. S.

Russia; Silk Industry. Bull. des Soies et Soieries, 1922, 45, 6.

Thirty-eight firms around Moscow are to try to make a start in spinning and winding silk. Government financial aid is asked. —F. G. P.

Trade Marks, Patents and Designs Federation. See This *Jl.* (Proc.), 1922, **13**, 68.

Cotton Consumption Statistics. See This *Jl.* (Proc.), 1922, **13**, 70.

Continued Education. See This *Jl.* (Proc.), 1922, 13, 61.

Foreign Exchanges and their Influence on Trade. See This *Jl.* (Proc.), 1922, **13**, 53.

10.—MISCELLANEOUS.

Bentonite. R. B. Ladov. Chem. Age, 1921, **5**, 834-835.

An account is given of the appearance, physical and chemical properties and occurrence of Bentonite, a variety of very fine clay. Bentonite has found industrial use in paper making, soap manufacture, in adhesives, and as a water softener, and it is suggested that it might serve as a filler for rubber, textiles, cordage, pressed and moulded electrical insulation material. A complete analysis of eight varieties of Bentonite is appended. —J. C. W.

Experiences with Ostwald's Colour Theory and Harmonies in Practical Weaving. M. Loescher. Textilberichte, 1922, **3**, 92.

The writer observes that purely scientific discussions on the theory are of very little use in practice, and so far it has found little application in technical work: the weaver must see the colours on the yarn. In addition, it has been found that certain shades, especially in the blues and greens, are not represented on the atlas. The author states that even if all formulæ and rules are observed it is still necessary to have good taste and empirical practical knowledge to obtain satisfactory results, and he maintains that the theory must be investigated by a capable, experienced weaver and converted into terms suitable to the practical man. —E. B. A.

Anthrax-Infected Wools. Wool Rec., 1922, **21**, 734.

The Dinsley-Pulman system of sterilising anthrax-infected wools uses an apparatus which, by a combination of X-rays and ultra-violet rays, will sterilise anthrax germs as effectually as the formaldehyde system, but will do it in the bale and so save time, labour and expense in unpacking, washing, scouring and re-packing the bale. It is claimed that if the experiment proves successful the Dinsley-Pulman system will reduce the cost of disinfection to ¼d. per lb. —L. M. S.

Water Softening for Industrial and Other Purposes. J. P. O'Callaghan. Jl. Soc. Dyers and Col., 1922, **38**, 81-84.

Continuous-automatic softeners such as the "Lassen-Hjort" are widely installed in this country. This system automatically performs the following functions:—Measurement of hard water; proportioning of the chemicals; settlement and filtration of the precipitate; regulation of the supply of both untreated and softened water. The "Permutit" system, however, requires no lime and no precipitate is formed, and possesses the following advantages:—Control can be carried out by unskilled labour; the temporarily exhausted permutit is restored to full activity by 10% salt solution in about 10 hrs.; all hardness is removed, water of zero-hardness being produced; chemical control is not required. —F. C. W.

ABSTRACTS

I.—FIBRES AND THEIR PRODUCTION.

(A)—MINERAL.

Weaving; New Method of——. See Section 3C.

(B)—ANIMAL.

Cyprus: Development of Silk Industry. Bd. of Trade Jl., 1922, **108**, 430.

The development and improvement of the silk industry in Cyprus are to be encouraged. The importation and sale of silkworms and the eggs of the silkworm moth are to be prohibited except in accordance with regulations. —L. M. S.

Silk Industry of Thrace. U.S. Commerce Reports, 1922, Feb. 13, 367.

The industry in 1921 was far below the normal, especially in the production of cocoons. The 1921 production amounted to only a little more than 25% of the production in 1911. A table is given comparing the production of the different regions in 1911 and 1921. The year 1921, however, showed an increase of more than 85% over 1920. —L. M. S.

Experiments in Breeding and Feeding Silkworm in West Prussia. R. Lucks. Bull. Agric. Intell. (from Biedermann's Zentralblatt, 1920, **49**, 190-196), 1921, **12**, 891-893.

Describes experiments carried out at the sericultural station of the West Prussian Sericultural Society. These experiments have shown that the silkworm can be fed without risk in West Prussia up to the middle of September. Comparative feeding experiments with (1) mulberry leaves, (2) leaves of Viper's-grass (*Scorzonera hispanica*), (3) mixture of leaves of mulberry and of Viper's-grass, (4) leaves of mulberry up to the fourth stage and with Viper's-grass during the fifth stage. The results are summarised. —W. R.

French Cocoon Crop; Decline in——. U.S. Commerce Reports, 1922, April 10, 78.

The French silk cocoon crop for 1921 was 2,524,149 kilos, against 3,230,630 for 1920. The yield of silk in proportion to the quantity of eggs set has, however, been increasing rather than decreasing. The unit production for 1921 was the highest for any of the last 10 years. French importation and exportation of silk cocoons for 1919, 1920, 1921 respectively (in kilos) were:—Imports 367,100, exports 137,100; imports 317,200, exports 186,000; imports 412,200, exports 130,000. Sericulture is said to be declining—the number of silk farmers in 1921 was 49,000, compared with 66,000 in 1920—and projects for building up again the mulberry orchards of Provence may be anticipated. —L. M. S.

Sericultural Institute at Portici and its Work. B. Moreschi. Bull. Agric. Intell. (from L'Italia Agricola, 1921, 58, 142-144), 1921, **12**, 1,004.

Refers to the work of this Institute near Naples since its opening in 1916, and especially mentions researches on "flacherie," on the orientation of the cocoon in relation to the laying of moths, and the manner in which the moths of *Bombyx mori* bore through the cocoons under abnormal conditions. —W. R.

Sheep Raising on the North Coast of N. South Wales. Experiment Sta. Record (from Agric. Gaz., N.S. Wales, 1921, **32**, 91-96), 1922, **45**, 875.

The experience of 10 years of sheep rearing on the North Coast of New South Wales has proved that this is not likely to become a profitable enterprise, owing to the high rainfall and temperature of this district. —W. R.

Action of Concentrated Sulphuric Acid on the Eggs of "Bombyx mori." A. Lécaillon. Bull. Agric. Intell. (from Comptes Rendus, 1921, **172**, 718-721), 1921, 12, 893-894.

Refers to previous work on the action of strong sulphuric acid on the eggs of silkworms and records conclusions derived from seven years' researches on the subject. It is found that the immersion of unfertilised eggs in concentrated sulphuric acid has an influence on certain of them that do not change colour naturally, and that the influence affects both freshly laid eggs and eggs at least 20 to 25 days' old. Concentrated sulphuric acid has no action on fertilised eggs whether freshly laid or laid 18 hrs. previously, or 5 or 7 months previously. The eggs lose their yellow colour when immersed, and the chorion appears to undergo some modification in structure, becoming more opaque. This would support Loeb's theory that the sulphuric acid renders the membrane more permeable to oxygen, but the alternative views of Delage and Goldsmith are discussed. —W. R.

Wool; Improving Home-Grown——. Text. Rec., 1922, **39**, 42.

With a view to improving the quality of and standardising Wensleydale wools and to eradicate black sheep from the flocks it has been decided to make the following experiments:—To mate with black ewes a ram which has already sired a large number of lambs, none of which are black; to mate silver greys together; to mate silver greys and thoroughly black sheep; to mate black or silver grey and pink; to mate pinks together. —L. M. S.

"Muscardine" ("Botrytis Bassiana"), a Disease attacking Silkworms and other Insects. C. Campbell. Bull. Agric. Intell. (from Il Coltivatore, 1921, **67,** 266-269), 1921, **12,** 1,005-1,006.

Refers to a serious outbreak of this disease in the low valley of the Liri, it being concluded from the evidence available that the disease was transmitted to the silkworm by other affected insects. It has been proposed by Ghirlanda to control the processional *Bombyx* of the pine by means of *Botrytis Bassiana*, but the author holds contrary to Ghirlanda that if this is done the presence of the fungus will constitute a serious danger to silkworms in districts devoted to sericulture. —W. R.

Annual Report of Department of Agriculture, British East Africa. See This *Jl.* (Proc.), 1922, **13,** 108.

Italian Crop Yields. See Section IC.

(C)—VEGETABLE.

Fibre; Production of——. S. Halen. Deuts. Faserstoffe, 1922, **4,** 25-27.

A summary is given of the most recent processes (from 1920 onwards) for obtaining fibre which can be used for spinning purposes from widely different sources. These processes include the production of pure fibre by the removal of incrusting substances; the manufacture of substitutes from cotton, and wool or cotton substitutes from flax, hemp, jute, etc., the production of "spinnable" fibre from wood, straw, conifer needles, the seed hairs of the plane tree, pumpkin tendrils, tow from stinging nettles, etc.; the production of paper-making material from the banana and other tropical fibrous plants. —J. C. W.

Flax Rust; Contribution to the Knowledge of the Life and Mode of Action of the—. F. Tobler. Faserforschung, 1921, **1,** 223-229.

An error having arisen in the abstracting of this article (This *Jl.* Abs., 1922, **13,** 79) the present translation should be substituted for that previously given. From his studies of the flax rust caused by *Melampsori lini* the author concludes that this fungus may especially attack the bast fibres of the host tissue and destroy the wall substance. The consequence is frequently the complete obliteration of the fibres. The presence of the fungus protects all affected tissues from the attack of pectic-splitting bacteria. The flax rust under some conditions not merely injures the fibres of the stems attacked, but can cause the former to completely vanish. Moreover it hinders the retting locally, and leads to the so-called "Tintenspritzen" of worked flax, in which the cortical tissues are bound fast with the fungus to the fibres attacked. Flax straw strongly attacked by rust is completely useless, and picking over of the former is therefore necessary. —W. R.

Hemp Fibres; On the Forked Ends of——. W. Müller. Faserforschung, 1921, **1,** 246-254.

An error having arisen in the abstracting of this paper, the present abstract should be substituted for that previously given (This *Jl.* Abs., 1922, **13,** 78). The author states that the occurrence of forked ends in hemp here and there cannot be denied. This can, however, no longer continue to be used as a character for the recognition of *Cannabis sativa* in the manner usual, up to now, in the literature because (1) it does not occur very frequently—it will indeed be found to be absent from many samples, and (2) flax also shows the same feature; indeed, according to Von Höhnel, the form of the ends is said to be a determining character in flax. The author holds that it is impossible to determine the geographical origin of hemp from the number and form of the forked ends. —W. R.

Ratooned Cotton. Text. Merc., 1922, **66,** 307.

Experiments carried out over a wide area show that ratooning, which is a general practice among the farmers in the Rustenberg district of S. Africa, tends to lessen the yield of cotton. The quality under the ratooning method tends to deteriorate and become shorter in staple. Ratooned fields are also more infested with cotton pests. The conclusion is entirely in favour of new annual planting. —J. C. W.

Scutcher. W. Mühlen. Leipzig. Monatsch. Text.-Ind., 1922, **37,** 7-8.

The construction and installation of scutching machinery is discussed. It is shown how errors which frequently arise may be corrected, so as to obtain better beating. —J. C. W.

Fiji: Cotton Growing, etc., Contemplated. Times Trade Supp., 1922, **10,** 104.

It is stated that there are thousands of acres of land eminently suitable for cotton-growing in Fiji, and also there is at present no danger of pests. The crop grows quickly, and some varieties are harvested within four or five months of planting.—L. M. S.

Adaptation of the Cultivation of Cotton on Sandy Soils in Egypt. D. P. Margos. Bull. Agric. Intell. (from Bull. de l'Institut d'Egypte, 1919-20, **2,** 1-8), 1921, **12,** 713.

Claims to have produced, by grafting Egyptian varieties on American arborescent cotton plants (*Gossypium barbadense L.*), shrubs which live for some 15 years and produce a cotton comparable with the best native kinds (Sakellaridis). The cultivation has been carried out on sandy soils on the borders of the Egyptian desert. Many claims are made for the advantage of this method, and the yields suggested are 10 to 15 quintals of raw cotton per hectare from the second year to a maximum of 35 quintals towards the eighth year. —W. R.

Italian Crop Yields. Times Trade Supp., 1922, **10**, 106.

The yield in 1920 and 1921 in tons of hemp was 97,800 and 100,000 respectively; flax, 2,300 and 2,500; cocoons, 29,700 and 30,600. —L. M. S.

Cotton; A Wild——. C. T. White. Experiment Sta. Rec. (from Queensland Agr. Jl., 1921, **15**, 216-218), 1922, **46**, 31.

The author describes *Bassia lanuginosa* as a new species of "wild cotton" occurring near the confluence of the Mayne and Diamantina Rivers, in Western Queensland. —L. M. S.

Cawnpore-American Cotton, II. B. C. Burt. Agric. Research Inst., Pusa, Bull. No. 126, 1921.

Describes further field trials on this cotton carried out during 1918 to 1920, and also spinning trials and market organisation. By pure line selection, with precautions against cross-fertilisation, a pure race has been isolated from the mixed acclimatised Cawnpore-American cotton. This yields well, has a staple of from 1$\frac{1}{16}$in. to 1$\frac{1}{8}$in. and is suitable for spinning 25's warps and 30's wefts in Cawnpore and up to 36's in Lancashire. Over 1,100 acres of this selection were grown by cultivators in 1920, and sufficient seed is now available to replace the original Cawnpore-American entirely. An independent market for unginned American cotton has been established in Cawnpore. —W. R.

Agricultural Development of Brazil. H. E. E. Pessoa. Bull. Agric. Intell., 1921, **12**, 801-802.

Inter alia, refers to the Brazilian Government Cotton Service created in 1919. Experiment stations and testing fields have been instituted for the improvement, selection, and propagation of the best varieties, for the study and improvement of local varieties, and for the control of diseases of cotton. A number of cotton diseases new to Brazil have recently been recognised and the very destructive pests previously known, viz., *Pectinophora* (*Gelechia*), *gossypiella* and *Alabama argillacea* receive special attention. Seed disinfection is being thoroughly studied. —W. R.

Aerobic Pectic Fermentation of Fibres. G. Ruschmann. Faserforschung, 1921, **1**, 67-94.

Gives a very full account of the more recent developments in processes of retting of flax and hemp by means of cultures of aerobic bacteria. The writer describes his own critical investigations with various bacteria, and considers particularly the problems of over-retting. The special advantages of the Rossi process are held to lie in complete absence of acid production by *Bacillus comesii* and correlated with this the fact that over-retting cannot occur, and Rossi's claim that there is no perceptible odour during retting by his process is confirmed. —W. R.

Cotton Stainer and Cotton Cultivation in Peru. C. L. Royle. Experiment Sta. Record (from Trop. Life, 1921, **17**, 86, 87), 1922, **45**, 860.

The cotton stainer *Dysdercus suturellus* is a source of great damage to cotton in Peru, where only two years ago it caused the entire loss of the crop expected from 30,000 acres. —W. R.

The Biological Separation of Fibre Stems. F. Tobler. Z. angew. Chemie, 1922, **35**, 97-104.

A critical survey of present-day knowledge of biological processes of retting. —W. R.

Bast Fibres; On the Local Swellings of——. E. Schilling. Ber. Deuts. Bot. Ges., 1921, **39**, 379-383.

Describes the localised swellings which have long been known to occur on certain bast fibres. The possible causal factors leading to their appearance are briefly discussed. —W. R.

Cottonising (of Flax Fibres); Principles of——. G. Kranzlin. Faserforschung, 1921, **1**, 121-137.

Discusses fully the principles involved in the utilisation of elementary bast fibres after processes of separation in machines adapted for spinning cotton so that mixtures of the latter and the bast fibres may be spun. As usually retted, the bast fibres are isolated in bundles of considerable length, but for the above purpose it is necessary to separate these into their individual fibre cells. A special technique has therefore come into use involving treatment with macerating fluids (often alkalis), and the various processes which have been patented are described and the chief literature summarised. —W. R.

Agriculture in S. Africa. Jl. Roy. Soc. Arts, 1922, **70**, 368-371.

There are now approximately 8,000 acres under the cultivation of cotton in the Rustenburg district, 2,000 acres in the Waterberg district, 100 acres in the Tzaneen section, 50 acres in the Transkei district, and 4,000 acres in Natal. Planting takes place during October and November, and the picking begins in April and continues until June or July. In the Rustenburg district the best results have been obtained from the class of cotton belonging to the big boll group. The average yield is 250-300 lbs. of lint per acre. Ratooning is practised in some sections. Ginning is done chiefly in the Rustenburg, Pretoria, and Lydenburg districts. —L. M. S.

Flax Variety Trials. J. de Vilmorin. Experiment Sta. Rec. (from Jl. Agric. Prat., 1921, **35**, 369-71, 410-412), 1922, **45**, 827.

Pskoff, a Verrières pedigree selection, and U.S. Selection 1803, with fibre 1·25 and 1·15 metres long respectively, ranked highest in trials of 63 fibre-flax varieties at Verrières in 1920. —W. R.

Cotton Prospects in the Philippines. R. B. Espino. Bull. Agric. Intell. (from Philippine Agric. Rev., 1920, **13**, 186-209), 1921, **12**, 850.

A more detailed abstract (See This *Jl. Abs.*, 1922, **13**, 79). The favourable geographical position of the Philippines in relation to Japan is discussed in connection with the great possibilities of production of raw cotton in the former for the markets of the latter. Acclimatisation experiments have been carried out and are still in progress. Native varieties have also been the subjects of experiments, since these are practically free from the attacks by weevil to which the American type are very susceptible. From the results of these experiments, it is concluded for the district of La Carlota that the cultivation of American or other foreign species is not advisable; that the native species Torquillo and Sangley are the only two to be recommended for cultivation on a large scale; and that seed should be sown early enough to allow the plants to mature not later than the middle of the dry season. —W. R.

Contribution to a Knowledge of "Hagelflaches" (Knotty Flax), I. E. Schilling. Faserforschung, 1921, **1**, 102-120.

Describes the pathological condition of flax expressed by knot-like swellings in the stems. The nature of the hypertrophies has been fully studied, and is shown to be due to an abnormal growth of the rind and of the wood of the stems. The bast fibres show local swellings and differential necrosis and absorption by proliferating rind cells with strong lignification of these. The causes of the uselessness of such plants as a source of raw flax are fully discussed. A literature list is appended. —W. R.

Australian Cotton Growing. Times Trade Supp., 1922, **10**, 164.

It is stated that the cotton-growing industry in Australia is beginning to assume important dimensions. Nearly 6,000 acres have been planted in Queensland this season, while the experiments in the Southern States have demonstrated to farmers that cotton-growing can be carried on successfully in conjunction with other forms of production. The land available for cotton production under irrigation may be estimated at several million acres. The Australian Cotton Growers' Association has begun the construction of a ginning plant near Brisbane. Cotton is already being received from the Central Queensland districts. —L. M. S.

Kenya Colony: Recent Agricultural Production. Bd. of Trade Jl., 1922, **108**, 513.

The actual production of sisal and flax respectively for 1920-21 was 123,820 and 37,063 bags (200lbs.); the estimated production for 1921-22 is 151,900 and 42,275 bags respectively. With regard to sisal half the plants are under 3½ years, and the other half range from that age to six years. —L. M. S.

Boll Weevils in 1922. R. B. Coad. Canad. Text. Jl., 1922, **39**, 161.

Records based on the number of live weevils found hibernating in Spanish moss in certain selected localities in Lousiana show a high rate of weevil survival this year. It does not of course follow that a very abnormally heavy emergence of overwintered weevils means an unusually great weevil damage, as the summer weather conditions may be sufficiently unfavourable to the weevils. However, a great abundance of boll weevils is anticipated. —L. M. S.

Sisal Hemp and Cotton in Zambesia. Times Trade Supp. (Trans-Zambesia), 1922, **3**.

The area planted in sisal hemp will shortly amount to about 5,000 acres. In 1920 the output was 345 tons, and it was expected to reach nearly 1,000 tons last year. The principal variety of cotton planted is Nyasaland Upland long staple, with an Egyptian strain, which gives an unusual lustre to the cotton. The total production in 1920 was rather more than 1,000 tons from an acreage of about 20,000. The cotton area extends along the south bank of the Zambesi, from Chemba towards the frontier of the Tete district. At Chemba there is a ginnery with a capacity of 2,000 tons. —L. M. S.

Growth and Correlation in Sea Island Cotton. T. G. Mason. W. Indian Bull., 1922, **19**, 214-238.

An attempt to ascertain how growth processes in one part of the cotton plant are related to those in neighbouring parts. The development of the central-axis system of branches was studied in two groups of cotton plants, from one of which the vegetative branches were removed. Although the rate at which the axis elongated, of node production by the apical meristem, and of flower-bud formation on the fruiting branches was found in all three cases to approximate closely to the course of an autocatalytic reaction, the similarity is held to be quite illusory. The coefficients of correlation between the number of nodes on neighbouring fruiting branches suggested that the decline in the growth rate of the central axis system was due to the presence of a correlating factor. This was associated with the development of fruit on the basal fruiting branches and to a lesser extent with the vegetative growth of these branches. The removal of the vegetative branches resulted in a greater development of the central axis system. The more limited growth of the central axis system seen in the unpruned plants is not explained by the competition with vegetative branches for either the solutes or the solvent of the soil solution. This more limited development of the unpruned group, as well as the decline in the growth rate of both groups, is suggested to be due to the removal of growth-promoting substances by the vegetative branches and basal fruiting branches respectively. This movement is associated with the translocation of carbohydrates. —W. R.

Cotton Raising in Portuguese East Africa. U.S. Commerce Reports, 1922, Feb. 13, 365.

It is reported that cotton growing on a large scale is being undertaken by a Portuguese group in Beira—on the eastern side of Lake Nyasa—and 150,000 acres are to be planted. —L. M. S.

Cotton and Sisal in British Nyasaland. Times Trade Supp. (Trans-Zambesia), 1922, 18.

Long staple American Upland cotton has given the most satisfactory results. The fibre obtained surpassed that of the original American stock in length of staple and silkiness—the plants proved hardy and blight resisting. Efforts to acclimatise Egyptian varieties have not been successful. The improved transport facilities provided by the Trans-Zambesia Railway and the coming extension of the Shire Highlands Railway to Lake Nyasa should prove a great stimulus to the industry. Both Mauritius and sisal hemp are successfully grown, and though the acreage under these crops is still small there is reason to believe that hemp will eventually become one of the most important crops of the Protectorate. Exports of fibre in 1920 amounted to 290,822lb., against 594,364lb. in the previous year. —L. M. S.

Diseases of Crops in the West Indies during 1920: Cotton. W. Indian Bull., 1922, **19**, 245-249, 260-261.

The pests dealt with are the cotton worm (*Alabama argillacea*), cotton stainers (*Dysdercus*), bush bugs (*Nezara viridula*), black scale (*Saissetia nigra*) and white scale (*Hemichionaspis minor*), flower-bud maggot (*Contarinia gossypii* Felt), leaf blister-mite (*Eriophyes gossypii* Banks), and a number of other insects. Details are furnished for each of the chief cotton growing islands of the prevalence of the particular pests during the period reported upon. The diseases caused by fungi and bacteria are similarly dealt with. —W. R.

Native Brazilian Fibres. U.S. Commerce Reports, 1922, April 24, 220.

The Brazilian Minister of Agriculture has reported that if the primitive processes now used in preparing the principal native fibres of Northern Brazil—caroca, the paco-paco, and the tucum—are superseded by chemical and mechanical processes in order to prepare thread for spinning, jute may be partially replaced. —L. M. S.

The Ecological Significance of Soil Shrinkage. T. G. Mason. W. Indian Bull., 1922, **19**, 125-137.

Concludes that the amount of shrinkage shown by any soil on air-drying is not determined solely by the degree of dispersion of its colloid particles, but also on the degree of aggregation of the particles into compound grains. —W. R.

Fibre Resources of Colombia. Jl. Roy. Soc. Arts, 1922, **70**, 439.

With further reference to the use of Colombian Pita, etc., fibres (see This *Jl.*, 1921, **12**, 273) it is reported that a machine has been perfected which will reduce the leaves of the plants of the wild pineapple family (*Bromelia* sp.) to fibre. *Bromelia sylvestris* yields a fibre which is divisible into one ten-thousandth of an inch and has as much tensile strength as flax. It also resists the action of water and takes dye perfectly and with a good gloss. *Bromelia pinuela* is also a valuable plant fibre. The fibres from other groups of the *Bromelia* family, known to the natives as Pita, Maya, Chivi-Chivi, Pinuela and Penguin—their value as to fibre and yield being in that sequence—are also described. Each machine will be capable of producing 250lbs. of fibre per day. From a ton of leaves, the gathering of which will cost about £2, there are produced 500lbs. of fibre. The machine is producing a fibre of about 18 to 24 ins. in length, with a shorter length fibre which automatically separates from the longer, of about 5in., for use in the manufacture of paper linen. A third part which automatically classifies itself is being bought in Barroquilla for use in upholstering. —L. M. S.

Niger Valley; The Improvement of the——. M. Bélime. Bull. Soc. Ind. Rouen, 1921, **49**, 417-428.

This subject is considered with special reference to the European cotton problem and in connection with the necessity for increasing the area of land under cotton crops. The production in other French colonies, especially French Soudan, is considered. Hydrography and the problems of irrigation are specially dealt with and a programme of development work is outlined. The possible use of tractors for cultivation is briefly mentioned, and a final paragraph deals with means of communication. —W. R.

Report of Agricultural Department, Bihar and Orissa, 1921. See This *Jl.* (Proc.), 1922, **13**, 108.

Report of Department of Agriculture, Bombay, 1920. See This *Jl.* (Proc.), 1922, **13**, 108.

Report of Department of Agriculture, Punjab, 1921. See This *Jl.* (Proc.), 1922, **13**, 108.

Annual Report of Department of Agriculture, British East Africa. See This *Jl.* (Proc.), 1922, **13**, 108.

The Physiological Humidity of the Soil and its direct Determination. See Section 6.

Spinning of Kapok? See Section 2B.

Protoplasm: Coagulation. See Section 6.

Soil Moisture. See Section 6.

Clay Particles. See Section 6.

(D)—ARTIFICIAL.

Cellulose Fibres; New Spinning Materials from——. E. Schülke. Textilberichte, 1922, **3**, 174.

The use of artificial silk for warps has for a long time proved difficult; also, the attempt to spin single threads as near as possible to natural silk has proved difficult because their strength is too low. Attention is called to several new German products—a thread spun from viscose according to the new patent of Dr. Bronnert; "Adlerseide"; "copper silk"; and Lanofil. The last-named is claimed to have an elasticity not inferior to wool and to be specially serviceable in admixture with wool and artificial wool; also it does not irritate the skin. —E. B. A.

PATENTS.

Treatment of Palm-Tree Leaf and Alfa. Bouvery and Conart. F.P.516,789. Appl. 18/5/20.

The leaf, fresh or dry, is soaked in water for 12 or 24 hrs., dried and combed, the roller being furnished with finer pins if necessary, then soaked in a bath containing a 10% solution of calcium chloride. A second solution is introduced, from the bottom of the vat, containing water and 2% (by weight) of sodium carbonate or 1% marine salt. The fibre is afterwards drawn out and dried in the air on hurdles upon a shed. —Bur. Text.

Flax and Hemp Retting. Société pour l'application industrielle des Brevets Peufaillit. F.P.518,535. Appl. 1/7/20.

The raw material is put in a vat at high temperature and treated with a liquid containing ethylene dichloride, trichloride or perchloride or dimethyl pentachloride poured in pure water, either alone or mixed. These solvents can also be used mixed with soap solutions or oily emulsions instead of pure water; 3% petroleum can also be added to the water. —Bur. Text.

Boll Weevils. D. P. Elliott, Rimini, S.C. U.S.P.1,405,573, 7/2/22. Appl. 7/7/21.

A machine for catching and destroying boll weevils, comprising, in the first place, what is described as a suction insect remover. —A.

Artificial Hemp; Manufacture of——. H. Nishimura, Japan. A.P.19,199. Appl. 17/12/20. Chim. et Ind., 1922, **7**, 768.

Cotton threads coated with a finish prepared from the root of *Hydrosine rivierii* are treated with tannic acid. In order to produce a transparent lustre on the surface of the threads the latter are boiled in a solution of sodium tannate or silicate. —L. M. S.

Artificial Silk. E.P.174,960 and 174,961. See Section 2.

Artificial Fibres. E.P.175,746. See Section 4.

2.—CONVERSION OF FIBRES INTO FINISHED YARNS.

(A)—PREPARATORY PROCESSES.

Cotton; Preparing——for the Cardroom. H. Wilkinson. Text. Merc., 1922, **66**, 168.

A lecture on precautions in the opening and blowing rooms to ensure the production of clean, even laps for the card-room. —J. C. W.

Cotton: Opening. Cotton, U.S.A., 1922, **86**, 320-321.

In a discussion of the Southern Textile Association on opening it was stated that the harder cotton is compressed the more ageing it needs. By opening and ageing, so that the cotton will have a uniform moisture content, better results are obtained in the subsequent processes. —J. C. W.

Cotton Opener. Cotton, U.S.A., 1922, **86**, 323.

In a discussion of the Southern Textile Association on picking it was stated that if attempts were being made to get the cotton clean it could be hit harder than if trying to get strength. About 54 beats per inch on the breaker and 60 on the finisher were recommended. On the blade beater between 35 and 40 was recommended. The carding beater does not hit the cotton as the blade beater does, but tends more to comb it. —J. C. W.

New Italian Machine for Unreeling Silk. U.S. Commerce Reports, 1922, Feb. 6, 316.

It is reported that an Italian silk expert has succeeded in perfecting a machine which will unreel the thread mechanically. If the invention succeeds commercially as well as it has done experimentally, it is anticipated that the cost of silk may be considerably reduced. —L. M. S.

Notes on Oils used in the Textile Industries. See This *Jl.* (Proc.), 1922, **13**, 101.

(B)—SPINNING AND DOUBLING.

Spinning of Kapok? F. Tobler. Tropenpflanzer, 1921, **24**, No.11/12.

Refers critically to a correspondence in the Manchester Guardian Commercial of 28th April, 1921, and points out that tests were carried out in Germany in 1910-11 by E. G. Stark resulting in a process for using kapok and other vegetable silks after treatment to remove woody substances. The hairs were generally spun in mixture with cotton. But the cost of using the material in Germany was prohibitive. Statements in the correspondence referred to above regarding the production and use of fabrics made from kapok are received with some incredulity, and the textile industry is warned to accept such statements with caution. —W. R.

Spinning Loose-Dyed Cotton. Cotton, U.S.A., 1922, **86**, 343-345.

An enquiry into the origin of static electricity in the manufacture of cotton and the methods by which it may be overcome. In his own mill, where dyed cotton is spun, the author traced the trouble to the dyehouse. A considerable amount of salt is always run in the last wash water before the cotton leaves the dyeing machine. If this salt is left on the fibre its hygroscopic action draws water from the air and thus keeps the cotton sufficiently moist to work well. The dyer had increased the washing and had apparently washed out the salt. The drying of the cotton had also been carried too far. By adjusting these two conditions and keeping the opener room doors closed and humidifiers going in the opener room and picker room, the trouble was eliminated. —J. C. W.

Removing Yarn Kinks in Twisting. Text. World, 1922, **61**, 33.

A simple attachment for twister frames is described. —L. M. S.

Preparation of Cloth for Finishing (Faults). See This *Jl.* (Proc.), 1922, **13**, 87.

Cellulose Fibres; New Spinning Materials from——. See Section 1D.

Dust in the Textile Industry: Removal of Dust in Flax, Hemp and Cotton Spinning. See Section 7A.

(C)—SUBSEQUENT PROCESSES.

"Yarnometer." Text. World, 1922, **61**, 1,797.

A device for improving yarns by mechanically stopping imperfections during winding is described and illustrated. Different models are manufactured for different kinds and sizes of yarns, but each model will handle a wide variety of sizes due to the several channels with which it is equipped. The device is simple in operation, and can be adjusted so that it will operate to a fine degree of accuracy, catching such imperfections as slubs, bad piecings, spirals, vegetable matter and small knots. —J. C. W.

Spooler Tension Device. Cotton, U.S.A., 1922, **86**, 345-347.

A simple ball and socket device which is automatically self-threading and self-cleaning is described. A smooth metal ball fits in a conical socket which is open at the bottom and has a vertical slit down the side. Guides converge on this slit for the purpose of threading. The yarn passes through the opening at the bottom of the ball receptacle, up one side and out over the top on to the spool. The metal ball rests against the yarn at some point during its passage through the conical receptacle and applies tension without any scraping action that might take the nap from the yarn. Dirt and lint fall out at the bottom of the conical piece without impeding the tension. This device differs from most others in overcoming the kinking of the yarn. The size of the ball varies according to the size of the yarn and the amount of tension needed.—J. C. W.

(D)—YARNS AND CORDS.

Artificial Silk; Working up of——. Wollen-u Leinen-Industrie, 1922, **42**, 100-102.

The author lays stress on the brittleness of the artificial silk fibre. In the process of working up the fibre into yarns and fabrics, it is essential to have all machinery in perfect order. All reels, etc., must be smooth and accurate, and tensions must be even to avoid knots and breaking. —E. B. A.

Spooler Tension Device. See Section 2C.

"Yarnometer." See Section 2C.

Faults in Bleached Yarns and their Causes. See Section 6.

PATENTS

Clearer for Yarn. Vitoux, gendre et fils. F.P.518,069. Appl. 28/6/20.

The clearer consists of an ordinary slit mounted on a metallic plate, and a second clearer with slit is mounted on an oscillating apparatus and perpendicularly to the first. The slits cross one another and the yarn goes through the two holes. —Bur. Text.

Carding. Grosjean. F.P.517,655. Appl. 23/6/20.

A disposal of cylinders and strippers is used instead of the usual main cylinder. The fibrous fleece is divided when entering the card; each part is carded separately, and all the parts are joined at the outlet of the card. Several cylinders are used at high speed alternating with strippers, the last of these strippers working with the first cylinder turning at high speed. The total quantity of card clothing is diminished and the efficiency of the card is increased. —Bur. Text.

Carding of Cotton. D. E. Molloy, Fall River, Mass. U.S.P.1,406,474, 14/2/22. Appl. 12/8/20.

In combination with the feed roll, feed table and licker-in of a carding machine, a knife is provided having an approximately horizontal disposition secured to and beneath the feed table with its edge presented to the periphery of the licker-in so that foreign substances will be removed from the lap and combing or straightening of the fibres will occur. —A.

Machine for Spinning, Washing and Drying Viscose Threads. M. Denis, Paris. U.S.P.1,408,350, 28/2/22. Appl. 31/3/21.

A machine providing for continuous operation, with means for drawing along the thread at predetermined speed. —A.

Waxing Yarns and Threads. W. H. C. Spencer, Leicester. E.P.175,096, 16/2/22.

A waxing and lubricating device is mounted in a winding machine, on a rod or stem which may be adjusted to vary the pressure during the waxing. —A.

Artificial Silk. E. Bronnert, Mulhouse, France. E.P.174,960, 3/2/22. Also E.P. 174,961, 6/2/22.

Relates to the draw-spinning process for manufacture of very fine threads of viscose silk (Spec. 16,588/03). According to the present invention, a viscose containing a high percentage of only slightly degraded cellulose is employed, and the coagulating liquid consists of a solution containing 0·5—1% of benzene mono- or di-sulphonic acid or lactic acid, 5% of ammonium sulphate and 5—10% of glucose. The later patent provides for modification of the process in the case of viscoses of viscosities higher and lower than the normal, by spinning apertures of a diameter greater or less than the normal 0·1 mm., and adjusting the minimum acid concentration to the cross-section of the spinning aperture and to the titre of the finished thread. —A.

Spinning. J. R. Williams, Rochdale. E.P. 174,973, 6/2/22.

Concerns anti-ballooning arrangements and relates to wire separators for ring spinning and like frames, particularly to those of the kind described in Spec. 104,018 and 109,864. —A.

Preparing Fibres for Spinning. Hudson and Lyles, Batley. E.P.175,768, 27/2/22.

Refers to apparatus for treating carbonized rags, etc. —A.

Spinning: Mules. B. K. Wrigley, Newton Heath, Manchester. E.P.175,883, 2/3/22.

The counterfaller is controlled at the end of the inward run by the engagement of a depending arm with a stop adapted to yield against spring pressure. —A.

Spinning Short Fibre. G.P.310,695. Deuts. Faserstoffe, 1922, **4**, 33.

The spinning qualities of short, smooth fibres may be considerably improved by treating the fibre with finely-powdered earthy substances, such as kaolin, talc, barium sulphate, calcium carbonate, gypsum, cement, etc., in the wet or dry state. Barium sulphate and calcium carbonate are preferably precipitated directly on the fibre; kaolin, talc, etc., may require the addition of an adhesive. Generally, however, it is sufficient to stir the pulverised material with water and to mix the resulting blend with the fibre. The pulverised material may also be previously treated with oil, paraffin solutions, or other fatty substances. Fibres so treated are more easily spun and do not show such a tendency to fly off the card. —J. C. W.

Method and Machine for reducing Cellulose to Fibres and for transforming the same into the liquid state. Otto Venter, Chemnitz, Germany. U.S.P.1,412,763, 11/4/22. Appl. 20/5/21.

The method consists in conducting the cellulose previously saturated with caustic soda repeatedly through a cutting and mixing machine wherein the material, whilst being conveyed, is submitted to a pressing action. —A.

Paper Yarn; Manufacture of——. E. Claviez, Adorf. G.P.302,459. Leipzig. Monatschr. Text.-Ind., 1922, **37**, 9.

A process is described by which it is possible to manufacture fine yarns from paper with or without admixture of textile fibres. The paper is passed between two or more rollers, the surfaces of which are notched or grooved. By this means it is converted into a so-called "fleece," consisting of irregular shreds of paper running lengthwise through the material and held together by still finer shreds. The strips for spinning are cut from this fleece. These fine strips are wound on spools and subjected to a special spinning process. The product is a spun yarn in the fullest sense of the word and not, as hitherto, a yarn obtained from rolled paper strips. The thinnest paper or blotting paper can be employed in the process. —J. C. W.

Spinning: Spindle Driving. J. Whitehead, Otley. E.P.176,953, 23/3/22.

A single tape is used to drive all or a section of the spindles on both sides of spinning, twisting, roving and like frames, being led from the tin roller to the spindle wharls and around a cylinder or around pulleys mounted on a shaft or around wharls. —A.

Spinning: Combined Drawing and Twisting Arrangements, etc. R. Kirk, Belfast. E.P.176,880, 14/3/22.

Roving from a revolving bobbin is simultaneously drawn and twisted by a drawing apparatus which rotates at or approximately at the same speed as the supply bobbin, and the spun yarn is continuously led for treatment by any subsequent process until the supply bobbin is exhausted. The drawing apparatus is modified to suit the kind of fibre being treated. —A.

3.—CONVERSION OF YARNS INTO FABRICS.

(B)—Sizing.

Coloured Size. E. Duhem. Chem. Abstr. (from Rev. text. chim. color; Industrie chimique, 1921, 8, 369), 1922, **16**, 834.

Certain fabrics can be dyed and sized in one operation. The colours are not as fast as with the usual methods. The size is prepared by boiling 300 litres of water with 6 kgs. of potato starch, 600 grms. of stearin and 500 grms. of white soap, and then adding the colouring matter, either organic or inorganic. —J. C. W.

Preparation of Cloth for Finishing: Faults. See This *Jl.* (Proc.), 1922, **13**, 87.

Dextrins; Testing——for their value as Sizing Agents. H. Pomeranz. Leipzig. Monatschr. Text.-Ind., 1922, **37**, 14, 33.
The following tests are described and discussed:—(1) Iodine reaction, (2) solubility in cold water, (3) the determination of the dry substance in an aqueous dextrin product or dextrin solution, (4) direct determination of matter insoluble in cold water, (5) differentiation of maltose and glucose by Barfoed's reagent, (6) osazone test. Specifications relating to the properties of commercial dextrins are given. The properties of a good size are discussed. In order that dextrin sizes shall possess these properties the dextrinisation process must not be carried too far. Tests are described by which the desired point in the reaction can be recognised. —J. C. W.

Flour Bacillus. See Section 6.

(C)—WEAVING.

Weaving; New Method of——. S. African Jl. Ind., 1922, **5**, 143.
A method of weaving in which the flying shuttle is eliminated is in process of being patented by Mr. A. F. Gritters-Doublet, of Pretoria. The inventor claims that the machine can be built to weave cloth of any width, and that several pieces of cloth, of the same or varying widths, can be woven simultaneously on a single machine, each piece with its own selvedge. The machine can be used for weaving asbestos. —L. M. S.

Shuttle. O. Thiering. Leipzig. Monatschr. Text.-Ind., 1922, **37**, 10.
Mathematical considerations governing the relative dimensions of the shuttle shed and frame lift in looms are explained. The larger the shuttle, the greater the amount of thread it can contain, but a larger shuttle requires also a greater depth of shed, with consequently increased strain on the warp threads and a greater number of breakages. It is shown that a shuttle of which the cross-section is of trapezium form has certain advantages in that it allows more room for the weft thread, and yet does not necessitate a greater depth of shed. —J. C. W.

Loom. Text. World, 1922, **61**, 29.
A description is given of a loom constructed in Massachusetts and said to be notable not only for its size but also for the method of driving and the several features embodied in the construction. Built to weave continuous tubular papermakers' wool felts, the loom is 40ft. long and is equipped with a 2½ h.p. motor at each end. The speed is 30 picks per minute, and the shuttles used are 28in. long. [Note: Big looms for the same purpose have been produced for some years past in Lancashire. —Ed.] —L. M. S.

Preparation of Cloth for Finishing: Faults. See This *Jl.* (Proc.), 1922, **13**, 87.

Blankets; Manufacture of Fancy Woollen—. See Section 3G.

Textiles in the New World; History of——. See Section 3G.

(D)—KNITTING.

Discoloration of Brown Stockings and Gloves by Formaldehyde. See Section 6.

(G)—FABRICS.

Textiles in the New World; History of——. M. D. C. Crawford. Color Trade Jl. (from Dyestuffs, Nov., 1921), 1921, **9**, 220-227.
The author deals chiefly with the history of American decorative textiles, dividing them into three distinct phases, the textile arts as practised by (*a*) Pre-Columbian America, (*b*) European and (*c*) modern. The origin of the weaving arts in the New World are traced, showing that the Peruvians understood and employed every technique known in fabric construction—tapestry, brocade, double cloth, lace, gauze, embroidery, pile knot and painted fabrics. Illustrations are given of terra-cotta blocks and clay cylinders with carved designs used for stamping textile patterns. The development of Colonial weaving principally concerned with the cotton and silk industries is explained and illustrated by a number of designs and fabrics produced in Alaska, Utah and Peru. —A. E. G. B.

Blankets; Manufacture of Fancy Woollen—. Text. World, 1922, **61**, 29.
Details of the stock used, yarn numbers, fabric constructions and weaves, weights and dimensions, and binding double fabrics and finishing operations are given for the manufacture of white bed blankets with borders, camping blankets, travelling rugs and Pullman blankets. —L. M. S.

PATENTS.

Tubular Fabric. E. Ingham, San Diego, California. U.S.P.1,403,785, 17/1/22. Appl. 27/3/19.
The third of 10 claims provides for the combination with a rigid arm of a circular weft needle mounted for oscillation thereon and a warp supporting form associated with the needles and carried by the arm. —A.

Loom. J. E. Clark and others, Detroit, Mich., Assrs. to Schaffer Co. U.S.P. 1,409,892, 14/3/22. Appl. 27/2/18.
The combination in a loom, of means to position the warp strands, a cylindrical shuttle and stationary electro-magnets to cause the shuttle to roll between the warp strands. —A

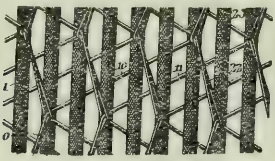
Looms; Pile fabric——. J. E. Grosvenor and W. T. Picking, Kidderminster. E.P. 175,450, 23/2/22.
Refers to improvements in loom mechanism for weaving velvet-pile carpets, etc. —A.

Loom Shuttle Threader. I. Snow, Lawrence, Mass., Assr. to Draper Cor. U.S.P.1,405,452, 7/2/22. Appl. 2/9/21.
An automatic threader having longitudinally extending thread passage, a thread directing top guide having two downwardly extended hooks forming a side entrance to the thread passage and a guard extending upwardly into the space between the downwardly extended hooks. —A.

Knitting Machine. H. T. Ballard, Norristown, Pa. U.S.P.1,406,253, 14/2/20. Appl. 15/1/20.
A rib machine having at each of two feeds means for making tuck and plain fabric, with alternate action so as to form diamond shapes where two spiral bands cross.—A.

Looms; Shuttle-guard for——. W. G. Fisher, Sunbury, Pa. U.S.P.1,406,835, 14/2/22. Appl. 26/9/21.
A shuttle trap comprising a semi-tubular structure having closed ends and arranged over the lay beam, the structure having on the lower side a plurality of inwardly opening shutters. —A.

Reinforcing Fabric for Tyres. T. Branson, Philadelphia, Pa., Assr. to Sibson and Stern. U.S.P.1,407,012, 21/2/22. Appl. 24/12/20.
A textile structure including, in combination, a series of cords extending longitudinally of the fabric and a groundwork in which the cords are laid, the groundwork comprising comparatively light binder threads inter-knit to form, in alternation with the cords, a series of co-extensive loop chains appearing on the face of the fabric structure, the binder threads, in order to form loops in remote loop chains, being zigzagged crosswise at the back of the fabric to embrace the group of cords in the interval, and the fields comprehended by the zigzagging of the several binder threads, arranged to overlap so that one group of cords is bound into the next. —A.



Pile-fabric Loom. M. R. Birmingham, Yonkers, N.Y. U.S.P.1,407,121, 21/2/22. Appl. 19/7/20.
Provides for combination of a wire supporting track with the pile wires, a working foot normally holding the free end of a pile wire in a fixed position on the track. —A.

Knitting Machines. Kenneth Howie, Philadelphia, Pa., Assr. to Wildman Mg. Co. U.S.P.1,407,684, 21/2/22. Appl. 23/7/19.
Refers to needle-pressing means for spring beard machine. —A.

Knitted Fabric. F. P. Walter, Oswego, N.Y. U.S.P.1,407,343, 21/2/22. Appl. 24/7/20.
A fabric composed of two webs containing independent opposed flat knit courses, a cross knit course connecting the loops in certain of the wales in the flat knit courses, other independent opposed flat knit courses engaging the loops in each wale, and a cross knit course connecting the loops in the remaining wales in the flat knit courses. —A.

Loom. J. C. Brooks, Paterson, N.J. U.S.P.1,405,096, 31/1/22. Appl. 2/10/18.
Provides for the combination with shed-forming mechanism of a plurality of weft nozzles adapted to deliver weft to the shed; means to bring any one of the nozzles into position to deliver its weft to the shed; means for blowing the weft from the positioned nozzle across the shed; and weft-measuring rolls, one for each nozzle, to measure the weft as it is delivered to the shed. —A.

Laminated Fabric. M. Hirshfield, Brooklyn, N.Y. U.S.P.1,405,511, 7/2/22. Appl. 3/3/21.
A fabric which comprises a facing of woven material of the silk type liable to ravel along cut edges and a co-extensive backing of non-woven material cemented to the facing to prevent ravelling thereof along the cut edges. —A.

Fabrics (threads and cords united). A. R. Trist, London. E.P.176,745, 16/3/22.
A fabric for use in super-imposed layers, for gland packing, hose piping, pneumatic tyres and belting, is composed of interwoven warp and weft threads and auxiliary threads overlaid on, and at an angle to, the warp and weft threads. The threads are impregnated with an agglutinant and the whole rolled into a smooth sheet by application of heat and pressure. The material is cut on the bias, thus enabling the auxiliary threads to assist the warp and weft threads to resist tensional stress.—A.

Starch Paste. G.P.342,610. Chem. Zentr., 1922, ii, 40.
Thick but smooth pastes can be obtained from starches which usually form lumpy masses when pasted with a little water (such as potato starch) by the addition of soap before or during pasting. —J. C. W.

Looms: Shuttle-positioning for Weft-replenishing Mechanism. P. S. Stott (Oldham) and J. Whittaker (Wilpshire). E.P.176,922, 23/3/22.
Refers to positioning of shuttles in looms with weft-replenishing mechanism. —A.

Knitting Instruments; Overthrow Guard. J. F. Wilcomb, Worcester, Mass., Assr. to Spartan Needle Co. U.S.P.1,403,931, 17/1/22. Appl. 24/5/20.

4.—CHEMICAL AND OTHER PROCESSES.

(B)—SCOURING AND DEGUMMING

Protectol Agfa I and Protectol Agfa II. Text. Colorist, 1922, 44, 249.

It is claimed that by the use of Protectol Agfa II the danger of injuring wool by the action of alkalies at high temperatures in the scouring process is overcome. Directions are given for carrying out the process with the addition of Protectol, and it is said that the wool scoured in this manner has a softer feel, greater elasticity and better spinning properties. The process can also be employed for scouring yarns, piece goods, cops, slubbing and bobbins, and also for union materials. Details are given for the use of Protectol Agfa I in the degumming of raw silk with caustic soda. Protectol Agfa I can also be added with advantage to the mercerising bath in partially mercerising half-silk for the manufacture of the so-called black and white (Grisaille) article. Other applications of Protectol are in the dyeing of animal fibres (silk and half-silk) with sulphur dyes; dyeing wool with indocyanine or milling blue brands; one-bath union dyeing with substantive dyes; fast wool dyeing, especially dyeing of worsted yarns and slubbing. It is claimed that it is possible to spin slubbing dyed in fast colours with chrome or metachrome dyes with an addition of Protectol in finer numbers than the same quality dyed without Protectol. —L. M. S.

Lime. See Section 4G.

(G)—BLEACHING.

Cellulose and Bleaching Substitute Pastes; New Process for Manufacture of——by Chlorine. de Perdiguier. Chim. et Ind., 1922, 7, 238-243.

The "de Vains" process is described and its superiority pointed out. In this process a 5% pulp is chlorinated with chlorine hydrate with such dilutions as to ensure that no considerable rise in temperature takes place and that the hydrochloric acid is generated at a low concentration to avoid the formation of hydro and oxycellulose. —F. C. W.

Bleaching; Notes on Hypochlorous Acid and Chlorine, with Comparisons of their Action. R. L. Taylor. Jl. Soc. Dyers and Col., 1922, 38, 93-97.

Experiments are described to show that pure hypochlorous acid solutions have very little bleaching property. Harrison's statement that "chlorine is a comparatively weak bleaching agent" and that in practically all cases of bleaching by hypochlorites, hypochlorous acid is the active agent is said to be erroneous. It was pointed out in the discussion following the paper that the active agent in bleaching is probably the hypochlorite ion.—F. C. W.

Bleaching. Oelker. Deuts. Faserstoffe, 1922, 4, 27-29.

A summary of innovations which have been proposed in the bleaching process during the last ten years is given. These include:—(1) The use of atmospheric oxygen, especially for bleaching raw cotton; (2) the use of an emulsion containing free stearic acid in excess for bleaching textile fibres; (3) the use of a mixture of sodium perborate and borax; (4) the use of magnesium perborate (the goods are heated under pressure with the perborate in the presence of soap, Turkey-red oil, etc.); (5) the use of gaseous ammonia after soaking the goods in a solution of hydrogen peroxide of concentrations up to 15%; (6) the application of per-salt solutions (the goods are alternately soaked in the cold solution, squeezed out and steamed until bleaching is complete); (7) the use of a strong alkaline solution of hydrogen peroxide (this may be employed without neutralisation of the caustic soda if a small quantity of an anticatalyst is added); (8) the use of ozone (it is proposed to centrifuge the wet goods subjecting them meanwhile to a spray of water containing ozone); (9) the use of electrolytic hypochlorite for bleaching vegetable fibre; (10) the use of a solution of sodium carbonate into which chlorine has been passed until the solution contains 1 to 2 molecules of chlorine per molecule of sodium carbonate. —J. C. W.

Lime. E. Holmes. Chem. Age, U.S.A., 1922, 30, 129-130.

A short general account is given of the uses of lime in the textile industry, together with a number of reasons justifying its general use in scouring and bleaching. —J. C. W.

Bleaching Faults in Linen caused by Metallic Impurities. See Section 6.

Faults in Bleached Yarns and their Causes. See Section 6.

Preparation of Cloth for Finishing: Faults. See This *Jl.* (Proc.), 1922, 13, 87.

Hydrogen Peroxide Bleaching. See This *Jl.* (Proc.), 1922, 13, 107.

(H)—MERCERISING.

The Heat Developed by the Action of Caustic Soda on Cotton ("Mercerisation"). See This *Jl.* (Trans.), 1922, 13, 113.

Protectol Agfa I and Protectol Agfa II. See Section 4B.

(I)—DYEING.

Alizarine Dyes; True——. G. Emmons. Silk, N.Y., 1922, 15, 70.

The process of dyeing silk, after mordanting with aluminium, tin, iron, or copper, with alizarine and allied colours, is described. —F. G. P.

Vat Dyes on Silk and Artificial Silk. Tiska. Textilberichte, 1922, 3, 186.

Vat dyes are less suitable for weighted silk than natural; on the former they are dull in colour, and the silk is weakened and loses up to 50% of its weighting. For Indanthrene Black the silk is boiled as little as possible and then dyed in a bath containing 12 c.c. of 40° Bé caustic liquor, 3 g. hydrosulphite, 3 g. lime, 3 c.c. Turkey Red oil, and 23% Indanthrene Black B double strength, and 5% Indanthrene Blue B.O. per litre. The silk is entered into the vat at 60°C., the temperature raised to 75°C. in ½hr. and kept at this temperature for ½hr., rinsed in hydrosulphite water, soured with sulphuric acid, diazotised and developed with β naphthol, wrung, soaped at the boil and brightened with acetic acid. A black equally fast to bleaching is obtained with Hydron Blue G and Indanthrene Golden Orange R.R.T., yellow shades with Anthraflavone G C, reddish with Indanthrene Golden Orange G, and green with Anthraflavone G C and Indanthrene Blue G C. —E. B. A.

Wool in Relation to Dyeing; Some Observations on——. J. W. Radcliffe. Jl. Soc. Dyers and Col., 1922, 38, 64-66.

Wool of different types or qualities dyes differently; the better the quality the less the quantity of medulla cells. Kempy wool is very fatty, with very pronounced medulla cells, nothing being left except the cuticle and medulla, with the result that the fibre could not be dyed. —H. R. H.

Mordanting Wool for Hematine. A. B. Craven. Jl. Soc. Dyers and Col., 1922, 38, 108.

Fully reduced chrome mordant gives a faster dyeing with hematine (fully oxidised) than partially reduced chrome, also greater fastness to rubbing. In order to replace the expensive cream of tartar sodium sulphite and bisulphite were investigated. These give good reduction of the chrome, but excess of sulphur dioxide destroys hematine; neutralisation with soda ash not only prevents this destruction but gives a more basic chrome mordant, and wool mordanted in this manner gives a 20% fuller shade than by other methods. A typical mordanting is:—3% chrome and 1% sulphuric acid; reduce in separate bath with 2½% bisulphite and 0·5% sulphuric acid, then treat with soda ash, 2½% on the weight of the wool, cold. —H. R. H.

Dyeing Cellulose Acetate. R. Clavel. Deuts. Faserstoffe, 1922, 3, 8-9.

A direct process for dyeing cellulose acetate, silk, or films is described. The cellulose acetate is treated with acid, basic, or direct dyes in the presence of organic acids and large quantities of soluble salts (*e.g.*, magnesium chloride, zinc chloride, etc.), preferably with the addition of protective colloids. The foaming process is used. —J. C. W.

Wool Dyeing; Discussion on Technical and Practical Faults in——. Jl. Soc. Dyers and Co., 1922, 38, 78-81.

Listed pieces cannot as a rule be caused by the dyer; they may, however, be caused by improper handling in the indigo vat or the padding machine. Flecked pieces are due to improper preparing, scouring, milling and carbonising, and often due to the use of inferior oils and hard water. Excellent results have been obtained by carbonising after dyeing, but this requires great care. Flecked pieces may also be caused by improper temperatures in dyeing. Weather stains, light patches which resist the dye due to oxidation of the oil in cloth, irregular streaks warp-way, and a mechanical fault similar to a mill-rig and probably due to overcrowding in the scouring machine were discussed. Paraffin wax used on warps was mentioned as a cause of unevenness. —H. R. H.

Artificial Silk in Dyeing; Behaviour of——. K. Biltz. Deuts. Faserstoffe (from Text. Forschung, 1921, 157-165), 1922, 4, 43.

The author has carried out experiments to test whether artificial silk suffers a loss in weight on dyeing and whether the tensile strength is affected by dyeing. The strength of single fibres after treatment with sodium sulphide or sodium sulphate in the case of viscose and copper-silk (cut) is somewhat increased; with viscose and copper silk (carded) it is slightly diminished. The strength of the dyed fibre of viscose and copper silk (cut) both in the initial and standing bath is increased, but with carded silk of both varieties the strength is somewhat decreased in the initial bath and increased in the standing bath. In the case of dyed yarn from viscose staple fibre the tensile strength is unaltered and the elasticity almost doubled. With 1/44 copper silk staple fibre the tensile strength increases, and the elasticity is almost doubled. In short, by dyeing the tensile strength and elasticity are influenced favourably. Faintly alkaline solutions also increase the strength and elasticity, the former up to 17%. —E. B. A.

Blue Dyeing of Linen, Linen Unions and Cotton. J. Werner. Textilberichte, 1922, 3, 136.

The faults of indigo are lack of fastness to rubbing, and in the case of heavy shades loss of colour in the first wash. It has become the custom to top with a cheaper colour. Too little use has been made of a combination of indigo and sulphur colours—either an indigo ground topped with sulphur blue or a ground of sulphur blue or black topped with indigo. In both cases, an essentially faster shade than indigo topped with a substantive dye is obtained. Fabrics which have to be subjected to frequent washing should at least be dyed with sulphur blue and topped with indigo. Substantive colours are good if the indigo ground forms 60% of the colour strength. Patterns are given. —E. B. A.

Mordanting of Wool: Tin replaced by Aluminium. H. Grosheintz. Bull. Soc. Ind. Mulhouse, 1921, **87**, 574; Pli cacheté 1,066, 1898. Report by P. Gerlinger, *ibid.*, 575.

Aluminium sulphate has been used instead of tin as mordant for printing wool. Woollen fabric, bleached or partially bleached, is passed four times into a jig containing 2 kg. bleaching powder (7%), 100 g. cryst. aluminium sulphate, 200 g. sulphuric acid 66°B. and 250 litres of water, then, without washing, is passed again four times into another jig containing 1 kg. sodium bisulphite 30°B., with the minimum quantity of water, and left rolled up for about ½ hr., then washed and dried. The advantages claimed are reduction in net cost and very great permeability on printing. Gerlinger suggests that the increased absorbent power of the wool is due to the action of the active chlorine. Modern methods for chlorinating wool would probably be much more effective. —L. M. S.

Aniline-Oxidation Blacks. Funk. Textilberichte, 1922, **3**, 130-131.

The superiority of aniline-oxidation blacks for the dyeing of yarn, hose, gloves and knitted goods is discussed. These dyes, by reason of their production on the fibre itself, give a fuller tone and, with reference to sulphur blacks, increased fastness towards light, washing, etc. Hermsdorf diamond-black is one of the best dyes for textile goods. It is very fast to washing even when the wash powder contains small quantities of chlorine. It weights the goods without making them hard. A loading up to 10% can be obtained. Reference is made to methods by which it may be determined whether aniline blacks have been used in dyeing. —J. C. W.

Vat Dyes. N. Evans. Jl. Soc. Dyers and Col., 1922, **38**, 112.

The application of the indigoid range of these dyes to silk is described. The use of soda ash, glue and Marseilles soap in the dye bath is recommended. Silk is not boiled after dyeing, but heated at 160°F. for ½ hr., washed and brightened with sulphuric or formic acid. Artificial silk may be dyed with both series of colour in the same way as cotton, but greater care is needed. —F. G. P.

Protectol Agfa I and Protectol Agfa II. See Section 4B.

Discoloration of Brown Stockings and Gloves by Formaldehyde. See Section 6.

Preparation of Cloth for Finishing: Faults. See This *Jl.* (Proc.), 1922, **13**, 87.

Notes on Oils used in the Textile Industries. See This *Jl.* (Proc.), 1922, **13**, 101.

Chrysaniline-Fuchsin Mixture; Fading of—. See Section 6.

Dye: Fluorescence. See Section 6.

Spinning Loose-Dyed Cotton. See Section 2B.

Coloured Size. See Section 3B.

Uviarc Fading Cabinet. See Section 6.

(K)—FINISHING.

Preparation of Cloth for Finishing: Faults. See This *Jl.* (Proc.), 1922, **13**, 87.

Polarisation Glarimeter. See Section 6.

Artificial Silk. See Section 6.

Blankets; Manufacture of Fancy Woollen—. See Section 3G.

(L)—WATERPROOFING.

Waterproof Linen Fabrics; The Preparation of——. J. Schmidt. Textilberichte, 1922, **3**, 134.

The waterproofing of light goods is carried out as follows:—Aluminium sulphate is stirred in hot water, lead acetate added, and the clear liquor, which must be free from acid, is drawn off. The fabric is passed repeatedly through a 6-7° Bé solution of this, and then wrung and dried at 40°C. for 48 hrs. The goods then pass through a boiling emulsion of soap, stearin, paraffin, beeswax, glue, linseed oil and ammonia, and then without drying through 2° Bé aluminium acetate, are wrung and dried 48 hrs. at 40°C. Finally, the goods are slightly damped and calendered slightly warm. The increase in weight is about 3%. For heavy goods the procedure is the same, but before calendering they are impregnated with 3° Bé aluminium acetate solution, dried, and passed through a mixture of ozokerite, paraffin, colophony and naphtha residues at 100-110°C., cooled in air and dried on a drying machine. The increase in weight is about 25%. Calcium acetate is also used, but is not so satisfactory. "Norgine," the water soluble sodium-ammonium salt of laminaric acid, is also used, but is inferior to calcium acetate. Ammoniacal copper oxide, which partially dissolves the surface of the fabric, which is then reprecipitated in the pores, is occasionally used. The use of viscose has given no positive results. With aluminium acetate, free from acid, and the drying process carried out at or below 40°C., the loss in tensile strength is about 8% in weft and 6·5% in warp. —E. B. A.

Waterproofing Paper. S. S. Bhatnagar. Jl. Phys. Chem., 1922, **26**, 61-71.

The waterproofing efficiency of a large number of bi- and ter-valent soaps has been determined. The adsorption of these soaps by the fibres of thick filter paper has been investigated. It is shown that Freundlich's empirical rule holds good in several cases. The methods of making waterproof basins from paper are briefly described. The usefulness of the adsorption process for waterproofing paper is discussed.—J. C. W.

Waterproofing Cotton Duck. J. W. Sawyer. Chem. Abstr. (from Amer. Dyestuff Reporter, 1921, **9**, Sec. 2, 13-16, 41), 1922, **16**, 835.

Waterproofing by the aluminium-soap method is employed when it is desirable to preserve the original feel and appearance of the goods. The paraffining method is used where firmness, stiffness, and weight are desired. Directions are given for carrying out both processes. Cloth is best dyed before waterproofing. As this class of goods is difficult of penetration, a deep bath and a slow motion through it are essential. —J. C. W.

Water Resistant Glue. See Section 6.

PATENTS.

Preparing Fabrics for Shearing Machine. Paulus. F.P.518,077. Appl. 28/6/20.

The pile of the fabric is raised up simultaneously in the direction of the warp by a rotary brush and in the direction of the weft by a brush with alternate motion. The position and inclination of the latter brush are obtained by mounting its frame on screwed axles and the frame of the first brush on axles levelled by wedges. —Bur. Text.

Waterproofing Fabrics. Blancke and Weingartner. F.P.518,056. Appl. 28/6/20.

The fabrics are soaked in a vat containing a solution of a soluble salt of the acid extracted from sea-wrack-grass (found in the Mediterranean, Baltic and North Sea). This salt is deposited on the fabric as an insoluble compound by decomposition with metallic salts, such as zinc sulphate, alone or with a solution of soap. The impregnated fabrics are afterwards dried and calendered. —Bur. Text.

Process for Washing Fabrics Soiled by Mineral Oils. Pinagel Chemische Werke für Textil-Industrie, Germany. G.P. 314,403. Appl. 19/7/16. Chim. et Ind., 1922, **7**, 768.

The fabric is first thoroughly impregnated with an alkaline solution of saponin, then with an alcoholic solution of a fulling oil containing only a slight quantity of fatty matter, and finally washed in the ordinary way. —L. M. S.

Method of Dyeing. A. Linz, New York. U.S.P.1,414,029, 25/4/22. Appl. 15/12/21. Also U.S.P.1,414,031, 25/4/22. Appl. 29/9/21.

The process, for dyeing textiles, leather, etc., comprises treatment with a solution prepared from a soluble compound of phosphorus and a soluble compound of difficultly fusible metal and an acid capable of freeing the acid from such compound; then dyeing the material in the usual manner. The second or divided patent refers to first dyeing and then treating with a complex acid containing phosphorus and tungsten. —A.

Method and Device for Bleaching Textile Fibres, Fabrics, etc. Robt. Mohr, Eibergen, Netherlands. U.S.P.1,404,467, 24/1/22. Appl. 24/3/21.

Consists in circulating a bleaching fluid in a closed circuit through the material to be bleached, filtering the fluid in a portion of the circuit, withdrawing gas at another portion of the circuit outside the bleaching zone and returning the gas into the filtered fluid on its return passage to the material. —A.

Process of Bleaching Material. Harry B. Smith, Albany, N.Y. U.S.P.1,404,242, 24/1/22. Appl. 19/7/21.

Comprises subjecting the material to a bath to which is added an alkali blue, an organic acid, and an alkaline oxidising agent. —A.

Inking, Coating, and Impregnating Machine. L. M. and H. W. A. Dixon, New York. U.S.P.1,404,589, 24/1/22. Appl. 10/10/17.

The machine for impregnating fabric comprises a pair of contacting rollers, one of which is uniformly cylindrical and adapted to engage the fabric and the other of which is peripherally recessed and supplies impregnating material to the first, the thickness of the film of the material being predeterminable. —A.

Prepared Fabric Belting. E. F. Gingras, Buffalo, N.Y. U.S.P.1,404,597, 24/1/22. Appl. 19/8/19.

Consists of treating one side with a rubber solution giving partial penetration and the other side with a solution of gum, the belting so treated being held under tension until the gum solution has hardened.—A.

Coated Fabric. J. A. Wilson, Elizabeth, N.J., Assr. to Duratex Co. U.S.P. 1,406,710, 14/2/22. Appl. 12/1/20.

Process of making coated fabrics comprising the application of a substantially continuous coating to the sheared nap of a fabric. —A.

Printing Yarns. C. Alvord, Worcester, Mass. E.P.175,310, 10/2/22. Also E.P.175,584, 10/2/22.

Warp yarns for carpets, etc., are wound on a drum rotated intermittingly to variable amounts controlled by Jacquard mechanism, the drum being brought to rest between these movements and printing effected by traversing a colour roller across all the yarns on the drum. When the drum moves through its smallest interval, a scraper acts so as to prevent a ridge of colour accumulating at the junction of two adjacent stripes. Spec. 175,584 relates to the scraper mechanism. —A.

Scouring Wool; Process of——. T. D. Smith, New York. U.S.P.1,405,560, 7/2/22. Appl. 7/5/21.

A process involving the treatment of wool for scouring in a bath containing dissolved potassium alginate. —A.

Transparent Cotton Fabric; Preparation of——. Heberlein and Co., A.-G., Wattwil, Switzerland. G.P.340,824. Leipzig. Monatschr. Text.-Ind., 1922, **37**, 35-36.

If cotton is treated with a solution of caustic soda cooled below 0°C. for a sufficiently long time it acquires a transparent appearance totally different from the ordinary mercerising effects. The caustic soda must be of such a concentration that it gives a mercerising effect at normal temperatures (*i.e.*, not less than 15° Bé). The transparent effect is not destroyed by washing and drying. The concentration of the solution, the temperature, and the time factor can be varied according to the quality of the material and the effect desired. Other modifications of the process, including the production of embossed effects, are described.—J. C. W.

Bleaching Textiles with Sodium Perborate. Chemische Fabrik Grünau Landshoff Meyer Akt.-Ges., and A. Noldeke, Germany. G.P.313,541. Appl. 18/12/10. Chim. et Ind., 1922, **7**, 768.

The bleaching liquor consists of free alkalies, soaps and salts of aluminium or aluminium hydroxide or aluminates. The aluminium compounds should be added in quantities such that no precipitate is produced. —L. M. S.

Mercerising Rovings, etc. A. Nelson, West Marton, near Skipton. E.P.175,741, 20/2/22. Also E.P.175,761, 24/2/22.

In a mercerising machine, etc., rovings, etc., are passed in rope or chain form through open tanks, through mercerising tanks surmounted by sealed chambers, and through washing tanks containing boiling water and surmounted by sealed steam-chambers having counterbalanced covers. The material is then drawn through a drying chamber or over drying cylinders, and coiled into cans. Yarns may be treated, and by filling the last washing tank with size the materials may also be sized. The second patent refers to the process of the mercerising. —A.

Dyeing Cellulose Acetate. British Cellulose, etc., Co., Ltd., and L. G. Richardson, Spondon. E.P.176,034, 28/2/22.

Partial or superficial saponification of cellulose acetate threads or fabrics by alkaline agents prior to or during dyeing is regulated or controlled by addition of sodium acetate in concentrations up to 5%. Spec. 169,741 referred to. —A.

Cellulose Acetate; Application of——. Farbenfabr. F. Bayer and Co. G.P. 347,276. Leipzig. Monatschr. Text.-Ind., 1922, **37**, 77.

Cellulose acetate in the presence of solutions of certain salts, such as thiocyanates, can be employed as a fixing medium for printing pigments on textile fibres. The presence of the salt solution eliminates the disadvantages usually experienced in the use of cellulose acetate in printing colours. —J. C. W.

Dyeing Cellulose Acetate. R. Clavel, Basle, Switzerland. E.P.176,535, 14/3/22.

Dyeing with acid, basic, or direct dyes, in baths containing at least one chloride and an acid, with or without protective colloids. The dyeing is preferably effected in a foam bath as described in Spec. 102,310 and 103,638. —A.

Process of Dyeing and Bleaching. J. F. King, Philadelphia, Pa. U.S.P.1,409,184, 14/3/22. Appl. 9/12/19.

A process consisting of dissolving sodium chloride, sodium carbonate, sodium peroxide, sodium sulphate, and caustic soda in water, adding a dye, and placing materials to be treated in the solution and subjecting the mass to heat. —A.

Artificial Fibres. W. P. Dreaper, London. E.P.175,746, 20/2/22.

So-called "staple fibre," obtained by cutting up filaments prepared from cellulose solutions, is rendered non-inflammable by treating the formed filaments, at a stage prior to the cutting up, with fire-proofing solutions such as are ordinarily employed in fire-proofing textile materials. The treatment may be after the usual drying process or in the case of viscose filaments optionally while in the gelatine condition, or in the case of nitrocellulose filaments immediately after denitration. —A.

Colloidal Plant Sprays. K. Albert and L Berend. E.P.169,758, 3/10/21.

Colloidal solutions of copper, mercury, silver, cerium, antimony and arsenic or of their insoluble compounds are prepared by treating these metals or their compounds, in powder form or as a soluble salt, with waste sulphite or soda cellulose liquor at temperatures above 100°. If a soluble salt is used the metal or its insoluble compound is formed during the process either by the addition of precipitants, such as alkali, or by the reducing action of the waste liquor itself, with or without other reducing agents, such as hydrogen sulphide. The colloidal product may be precipitated and used, among other purposes, for the protection of plants and the impregnation of wood or fabric. The colloidal products may be employed alone or in conjunction with oil, resin and other organic emulsions, or with the addition of colloids or filling substances. In the case of plant protection, other material, such as aluminium hydroxide, gypsum, etc., may be added to the colloidal products. —J. C. W.

Bleaching Fabrics, etc. J. Hodson, Diggle, Yorks. E.P.176,869, 13/3/22.

In the white bleaching and colour bleaching of textile fabrics and materials the goods are first boiled in a solution of water, ammonia, soda ash and soap. They are then washed in hot soap liquor and chemicked. The provisional specification provides for the material being chemicked both before and after treatment with the hot soap liquor. —A.

5.—LAUNDERING AND DRY-CLEANING.

Rust and Oil Stains; Removal of——from Cotton Fabrics. P. List. Papierfabr. (from Z. f. ges. Text.-Ind., 1921, **24**, 371), 1922, **20**, 406.

Directions are given for removing rust and oil stains from cotton fabrics. It is also stated that invisible oil spots can be detected by treating the goods with ferric or ferrous sulphate and subsequently with weak sodium carbonate solution. The appearance of dark coloured spots indicates the presence of stains. These can be removed by treating the material with a solution containing 1 part of soft soap, 1 part of commercially pure glycerol (250°B) and three parts of water at 60°, and washing thoroughly. —J. C. W.

PATENTS.

Dry Cleaning Plant. P. F. Smith, Utah. U.S.P.1,385,724, 26/7/21. Appl. 12/6/20.

A new dry-cleaning system is described in which a continuous circulation of the liquid detergent is maintained between the source of its supply and the washing machine, and the liquid detergent is cleansed and purified immediately after use in a centrifugal extractor filter, without the necessity for settling or distilling, and then returned as a clarified liquid to the washing machine, thus eliminating the necessity of rinsing the clothing. A diagram of the plant is given. —J. C. W.

6.—ANALYSIS, TESTING, GRADING, AND DEFECTS.

Spectrophotometer. A. L. Narayan. Phil. Mag., 1922, **43**, 662-663.

A modified form of double slit spectrophotometer is described. It consists essentially of an electromagnetically-maintained pendulum which executes 120 oscillations per min. The bob is a heavy frame of brass containing two rectangular apertures one above the other, there being a well-defined line of demarcation between the two. The widths of both slits can be adjusted by independent micrometer screws. The whole pendulum is mounted in front of the collimator slit of the spectrograph so that the line of separation of the two slits almost bisects the collimator slit. The slit widths are then adjusted so as to get equal illumination in both of the spectra. —J. C. W.

Lambrecht Hygrometer. Z. f. Instrumentenkunde, 1922, **42**, 53-54.

A description is given of the original Lambrecht's distant-reading hygrometer. By means of electrical adjustments, measurements at any optional number of places, mutually separated by various distances, can be made from one centre. Contrary to other systems, the hair hygrometer is employed as hygrometric instrument. —J. C. W.

Artificial Silk. R. Frank. Deuts. Faserstoffe (from Wollen-und Leinen-Industrie, 1921, No.23, 332-333), 1922, **3**, 3.

Artificial silk, it is stated, loses its strength completely when subjected to heat and pressure in finishing processes. The structureless, cylindrical fibre is completely deformed, the lustre of the silk is simultaneously diminished, and frequently the shade is changed. —J. C. W.

Polarisation Glarimeter. K. Kieser. Deuts. Faserstoffe, 1922, **3**, 1-2.

An instrument for measuring the gloss of the surfaces of materials is described. The principle of the apparatus is the same as that of the Ingersoll glarimeter (see This *Jl.* Abs., 1922, **13**, 48). The instrument was originally designed for measuring the gloss of paper surfaces, but its application to textiles is indicated. —J. C. W.

The Physiological Humidity of the Soil and its direct Determination. T. G. Mason. West Indian Bull., 1922, **19**, 137-154.

Describes in outline the more important methods of determining the physiological humidity of the soil, and details a new simple method for directly measuring this humidity. —W. R.

Gluten; Properties of——. P. F. Sharp and R. A. Gortner. Jl. Phys. Chem., 1922, **26**, 101-136.

" Strong " flour gluten has a much higher rate of imbibition than " weak " flour gluten in the case of both acids and alkalis. Dispersion takes place more rapidly and at lower concentrations in the case of alkalis than in acids. Addition of sodium sulphate to potassium and calcium hydroxides lowers the apparent imbibition rate, but a low rate in a weak flour does not appear to be dependent on, or to be determined by, a higher salt content. The physico-chemical properties are altered by drying the glutens washed from different flours in a vacuum oven at 45-50°C., the properties of the different glutens becoming more nearly alike. This is in accord with the theory that the " strong " gluten is " strong " because of more pronounced colloidal properties. The postulation is confirmed that a " weak " flour is " weak " because the gluten is not so perfect a gel as is the gluten of a " strong " flour. Evidence is presented tending to show that the optimum hydrogen-ion concentration for the imbibition of discs of gluten is the same for the various acids. —J. C. W.

Inulin. J. J. Willaman. Jl. Biol. Chem., 1922, **51**, 275-283.

Details are given of a satisfactory method which has been evolved for preparing inulin from artichokes. A method of preparation of a fructose syrup from these tubers is also outlined. Data obtained in the course of the experimental work confirm Dean's hypothesis that inulin is a group of substances with large, loosely bound molecules, and not a single substance. —J. C. W.

Continuous-flow Calorimeter. F. G. Keyes, L. J. Gillespie and S. Mitsukuri. Jl. Amer. Chem. Soc., 1922, **44**, 708-710.

A continuous-flow calorimeter for studying heats of neutralisation is described. The reacting liquids are led down from reservoirs through coils of silver tubes immersed in an upper constant-temperature bath, then through silver coils immersed in a lower, precision thermostat, and finally are squirted through fine nozzles into the mixing calorimeter. The mixed liquid passes out of the calorimeter through a narrow tube which permits the mixture to be collected and weighed at intervals. The rates of flow are carefully adjusted so that equivalent quantities of the two liquids shall mix. One platinum thermometer is immersed in the oil of the precision thermostat and another in the mixed liquid in the vacuum-jacketed space of the calorimeter. The difference in temperature is a measure of the heating of the mixture by the reaction taking place in the calorimeter. —J. C. W.

Starch: Constitution. P. Karrer and A. P. Smirnoff. Helv. Chim. Acta, 1922, **65**, 187-201.

The conception that starch is a polymerised form of diamylose (anhydromaltose) receives further support from its interaction with phosphorus pentabromide by which aceto-1:6-dibromoglucose is obtained but no aceto-1-monobromoglucose. To account for all the properties of starch, the oxygen bridge must link up carbon atoms 1 and 12. A clear and very simple explanation of the synthesis of carbohydrates in plants is put forward on the grounds of these results. —J. C. W.

Dye: Fluorescence. R. W. Wood. Phil. Mag., 1922, **43**, 757-765.

By operating with a very intense beam of light, sufficient quantities of the transformation products produced by the action of light on fluorescent solutions were obtained to make it possible to examine their optical and chemical properties. Usually, the decomposition of the fluorescent substance yields a coloured non-fluorescent substance which the author terms a photo-compound and which is bleached by the further action of the light to a colourless solution. Solutions of fluorescein, eosin, rhodamine, phloxine, resorufine, acridine-orange and naphthaline-red were examined. The influence of temperature on fluorescence, the intensity relation between fluorescent and exciting light, and the function of the intensity of the exciting light were investigated. —J. C. W.

Electric Thermostat. S. C. Bradford. Biochem. Jl., 1922, **16**, 48-52.

A simple electric thermostat, which can be made from material generally at hand and is constant to 0·02°, is described and illustrated. —J. C. W.

Chrysaniline-Fuchsin Mixture; Fading of——. W. W. Paddon. Jl. Phys. Chem., 1922, **26**, 288-291.

An experimental enquiry into the effect of light on fibres dyed with a mixture of chrysaniline and fuchsin. Contrary to previous statements, it was found that a mixture of these two dyes does not fade faster than either dye by itself. The data obtained show that chrysaniline alone on the fibre is more fugitive than any of the mixtures of the two dyes tried. The mixed colours fading first were those in which the minimum amount of fuchsin was present. Fuchsin exerts a protective action against light on mixtures of fuchsin and chrysaniline. Similar results were obtained in the case of aqueous solutions of the dyes. —J. C. W.

Celloisobiose. H. Ost and G. Knoth. Cellulosechemie, 1922, **3**, 25-38.

An extensive report on the physical and chemical properties of celloisobiose and its acetates. —J. C. W.

Water Resistant Glue. R. H. Bogue. Chem. Age, U.S.A., 1922, **30**, 103-106.

Casein and blood albumin glues have been proved satisfactory for water resistant purposes. The commercial manufacture of casein and the methods of preparation of casein and blood albumin glues are discussed. Several useful recipes are given. —J. C. W.

Xylenol Blue; Application of——as an Indicator. A. Cohen. Biochem. Jl., 1922, **16**, 30-34.

Xylenol blue, or p-Xylenolsulphonephthalein, a new indicator having two working ranges of utility from pH 1·2 (red) to 2·8 (yellow) and from pH 8·0 (yellow) to 9·6 (blue), can be successfully employed in all chemical and biochemical work for which thymol blue has hitherto been recommended. The facts that *p*-xylenol is easily prepared from diazotised *p*-xylidene and only half as much Xylenol blue as thymol blue is required should render its use preferable. —J. C. W.

Biocolloid; Structure of——. E. J. Witzemann. Jl. Phys. Chem., 1922, **26**, 201-216.

In a theoretical discussion of the factors which influence the transition from crystalloid to colloid properties within a homologous series it is shown that the relations involved can be considered in simple terms of chemical constitution. The emulsoid structure of biocolloids constitutes a gross heterogeneity which is also present in a much less conspicuous form in the lower crystalloid members of the same series. The particular properties of biocolloids arise from the cumulative effect of certain groups in the molecule. The effect of chemical constitution is especially easy to trace with the soaps and less easy with the carbohydrates and proteins. The constitutional reason for the colloidal state in the case of starch and cellulose is discussed. —J. C. W.

Pectin; Estimation of——. M. H. Carré and D. Haynes. Biochem. Jl., 1922, **16**, 60-69.

The precipitation of pectin as calcium pectate is described. It is shown that by a careful adjustment of conditions this can be used as an accurate method of analysis, and that the precipitate corresponds in composition to the empirical formula $C_{17}H_{22}O_{16}Ca$. A method is given for the extraction of soluble pectin from apples. —J. C. W.

Wood Cellulose; Contributions to Chemistry of——. L. E. Wise and W. C. Russell. Jl. Ind. Eng. Chem., 1922, **14**, 285-287.

The first part of an investigation of the chemical properties of wood cellulose as compared with those of cotton cellulose is described. Spruce sulphite pulp was employed for the experiments and evidence is presented that normal cellulose is the precursor of cellobiose octa-acetate, and that normal spruce cellulose yields the same amount of the octa-acetate as does normal cotton cellulose under identical conditions of acetolysis. The authors therefore consider that Hibbert's formula (see This *Jl.*, 1921, **12**, 125, 184) may represent the constitution of normal spruce cellulose as well as that of normal cotton cellulose and that their experiments present additional evidence that cellulose from the "lignocellulose" of wood and cotton cellulose may be identical. —J. C. W.

Soap Solution; Surface Tension of——. A. L. Narayan and G. Subrahmanyam. Phil. Mag., 1922, **43**, 663-671.

Experiments are described which show definitely that the surface tension of soap solutions is the same for all concentrations between very wide limits. The experiments also confirm the reliability of the bubble method for studying the surface tension of soap solutions. The close agreement between the results obtained by the soap-bubble method and those obtained by the capillarity method shows that the angle of contact is in this case 0. —J. C. W.

Artificial Silks. E. Rutenkolk. Deuts. Faserstoffe (from Z. f. gesamte Text.-Ind., 1922, No.6), 1922, **4**, 31.

In the dyed state natural silk is soft and supple, whereas artificial is firm, resistant and brittle, and has a hard feel. The elasticity and strength of artificial products are much less, especially if damp. With damp artificial silk it is possible by bending backwards and forwards to tear a number of threads; with natural silk this is impossible. Natural silk burns slowly and with difficulty and leaves some ash; artificial burns rapidly and leaves no noticeable residue. Single threads of artificial silk are not so fine as natural. Up to the present the finest artificial silk has a fibre of 50 deniers, but its manufacture is expensive owing to residues; such fine threads are difficult to use as warp, owing to low strength and elasticity. The great disadvantage of the artificial product is the irregularity in the fibre.—E. B. A.

X-Ray Spectrograph. H. Seemann. Z. tech. physik, 1922, **3**, 57-59.

An account is given of an X-ray spectrograph constructed for the investigation of the hardest region of the spectrum. It can be adapted to the pin-hole camera or for the window method as desired. Its range may be extended considerably by using rock salt as the reflecting crystal and still further by replacing rock salt by gypsum. An illustration of the instrument is given. —J. C. W.

Fibre Knowledge; The Need of more Exact——. J. McDowell. Text. World, 1922, **61**, 2,065, 2,109.

The author emphasises the importance of more exact knowledge of the single hair in the selection and buying of cotton and discusses the characteristics and method of identification of a good cotton. The use of microphotographs of typical samples is recommended for detecting immature and over-ripe fibres and to see whether the twist extends reasonably near to the base and tip of the fibre. —J. C. W.

Uviarc Fading Cabinet. Text. World, 1922, **61**, 2,084.

This apparatus is designed for testing the fastness of dyes on textiles by making use of the fading caused by ultraviolet rays. The cabinet is self-contained, and a number of samples can be simultaneously exposed in it to the action of the rays from a quartz mercury vapour lamp. A portion of the sample is screened from the Uviarc rays, and the degree of fading is judged by comparison with the exposed part of the sample. —J. C. W.

Water Purification; Developments in——. H. L. Tiger. Text. World, 1922, **61**, 385.

Impurities may be either in the form of suspended or dissolved matter. The former is removed by filtration, assisted if necessary by a coagulant. Dissolved oxygen is the principal agent in the corrosion of iron in water, and it may be removed from boiler feed water by heating to boiling point in open heaters before passing into the boilers. Hydrogen sulphide gas is frequently found in water, and may be removed by aeration. Hardness in water causes formation of boiler scale, clogging of spray nozzles in humidifiers, formation of curds in wool scouring, silk degumming, and cotton boiling off, and irregularities in dyeing. Hardness can be completely removed by a zeolite plant. The presence of iron in water is fatal to dyeing and bleaching. When it occurs in deep well waters it may be removed by aeration, followed by filtration; when present in a surface supply in combination with organic matter it may be coagulated with alum and filtered out. Manganese has effects similar to those of iron; it can be removed by using a special zeolite bed which is regenerated by a solution of potassium permanganate. —V. M.

Faults in Bleached Yarns and their Causes. Wollen-u. Leinen-Industrie, 1922, **42**, 97.

Specks on raw yarn are due to irregular packing in the kier, resulting in the fats and waxes becoming only partly saponified and removed. Specks are also formed by the string used for tying the hanks containing woody particles or being strongly paraffined and can be removed by washing, or avoided by boiling the string before use. Boiling specks are formed if insufficient water is run over the goods after boiling. On opening the vessel, owing to the high temperature, the kier liquor dries on the surface of the hanks. Further, the concentrated liquor in the presence of air forms oxycellulose. This trouble is avoided by immediate and sufficient flooding of the goods so that the liquor is cooled and diluted. With bad packing, the liquor tends to circulate through channels, and the cotton forming the walls of these is subjected to more intense action, whilst at certain concentrations the cotton again absorbs the dissolved colouring matters. Brown discolouration is also formed with hard waters owing to a deposit of salts and can be removed by washing with acid, but are best avoided by settling the kier liquor overnight. Rust spots formed by iron nails, rust from water pumps, etc., can be partially removed by washing or acid before bleaching. If present during the latter, oxycellulose is formed at these spots and the fibre is weakened. Oil spots if not dry may be removed with hot soap solution; after bleaching they remain as yellow spots. —E. B. A.

"Triamylose." P. Karrer and E. Bürklin. Helv. Chim. Acta, 1922, **5**, 181-187.

Evidence is presented to show that the so-called triamylose is identical with β-hexa-amylose, and is therefore a polymerised anhydro maltose and not a polymerised anhydro trisaccharide. The two compounds were proved identical in the following points: (1) Sodium hydroxide addition compound, (2) non-reaction with pancreatic extract, (3) water of crystallisation, (4) solubility in water, (5) specific rotation, (6) crystal form. The differences previously observed in their properties may have been due to the presence of traces of impurities. The authors state that molecular weight determinations cannot be trusted in the elucidation of constitution. The significance of these results in starch and cellulose chemistry is discussed. —J. C. W.

Pectin; Detection of——. A. Herzog. Faserforschung, 1921, **1**, 163-164.

Attempts have been made to apply the micro-chemical reactions of pectin to its macro-chemical detection, but the author does not recommend the method. In the colour reactions investigated, particularly those with Ruthenium-red and copper or iron salts, the differences of colour shade obtained are too small to be of practical value. —J. C. W.

Cellulose. P. Karrer and A. P. Smirnoff. Helv. Chim. Acta, 1922, **5**, 187-201.

The authors treated cellulose triacetate with phosphorous pentabromide and obtained aceto-1:6-dibromoglucose. They deduce that cellulose must be a polymerised form of cellosan, an anhydro-cellobiose and present a formula in agreement with their conclusions. This formula also accounts for the production of 2:3:6-trimethylglucose and the non-production of tetramethylglucose in the breaking down of methylated cellulose. The conception of cellosan, not only as an anhydride of cellobiose, but as an anhydride of maltose or isomaltose, is discussed. According to which of the two glucosidic linkings is attached in reactions, cellobiose, or maltose, or isomaltose, should be formed. The fact that maltose has never hitherto been detected among the hydrolytic products of cellulose is due to its extreme susceptibility to acids. The formation of maltose would also account for the low yields of cellobiose acetate obtained from cellulose. It has thus been proved, without recourse to any theoretical hypothesis, that maltose or isomaltose linkings occur in cellulose. —J. C. W.

Neon Tube; Application of——. B. E. Shackelford. Chem. and Met. Eng., 1922, **26**, 703.

A neon-filled Geissler tube is mounted in an insulating casing and provided at one end with a small metal contact tip and at the other end with a condenser plate. The capacity of this plate to ground is sufficient for the current necessary for operation so that when the tester is brought near a live high-tension line or is touched against a body statically charged the characteristic orange red neon glow becomes visible. It is believed that this tube will prove of great utility in plants and factories where static electricity is troublesome. A diagram showing constructional details of the neon tester is given. —J. C. W.

Soil Moisture. F. W. Parker. Jl. Soc. Chem. Ind. (from Soil Sci., 1922, **13**, 43-54), 1922, **41**, 263A.

The presence of "unfree water" in soils is questioned. The abnormal increase in freezing point depression with decrease in moisture content of soils is brought about by finely divided solids and not by "unfree" water. Glycerol and alcohol do not extract "unfree" water from soils. It is possible to displace soil solution from soils having a moisture content less than the content of "unfree" moisture. In soils containing amounts of water less than the "water-holding capacity," the water is held by forces of adhesion which increase with decreasing moisture content, and which may eventually become sufficiently great to prevent the freezing of the water. The older classification of soil moisture into hygroscopic, capillary and gravitational water is preferred to the classification proposed by Bouyoucos. —J. C. W.

Cloth; Tendering of——. T. Hadfield. Text. World, 1922, **61**, 1795.

Acids, even in traces, weaken cloth and make it less able to resist friction and climatic conditions. The effects are much more strongly marked with sulphuric than with hydrochloric acid. Sulphuric acid may ultimately effect complete disintegration of a fabric. The conversion of the cellulose into hydrocellulose is not necessarily accompanied by diminution in the amount of the hydrating acid present. Cloths dyed with fugitive colours are soon affected. Periodical testing of materials used in sizing, etc., for impurities which may give rise to the presence of acids in the finished cloth is advocated. Methods of testing cloth for free acids are described. —J. C. W.

Clay Particles. H. G. Schurecht. Chem. Abstr. (from Jl. Amer. Ceram. Soc., 1921, **4**, 812-821), 1922, **16**, 805.

The method of making sedimentation tests for classifying extremely fine clay particles is to determine the suspended weight of a glass plummet suspended in the clay slip, at different intervals of time. It is possible to classify particles as small as 0·0001 mm. by this method, whereas elutriation does not give a practical separation below 0·003 mm. The bulk of many clays is below 0·003 mm. Other advantages are claimed:—(1) Ease of maintaining a constant temperature during the test; (2) the electrolyte content remains constant; (3) rapidity; 10 sedimentation tests can be made in the time required for one elutriation test. —J. C. W.

Camphor; Application of——. K. Rast. Ber., 1922, **55**, 1,051-1,054.

If camphor is used as solvent in the cryoscopic method of molecular weight determination the depression of the freezing point is so great that the Beckmann thermometer can be replaced by an ordinary thermometer. The determination can be carried out in an ordinary melting point apparatus. The method of procedure is described. —J. C. W.

Flour Bacillus. A. J. J. Vandevelde. Chem. Abstr. (from Reprint from 18th Vlaamsche Natuuren Geneeskundig Congres, 1919, 9-12), 1922, **16**, 762.

The existing knowledge concerning "sticky" or "slimy" bread and the causative organism (a member of the B. mesentericus group) is briefly summarised. This thermostable organism occurs in the flour even when it is of the highest grade. There is no known way of destroying these organisms, and only preventive measures can be taken. Chances of growth are diminished by substances which increase the acidity (*e.g.*, sour dough, lactic acid, acetic acid) by long baking, preferably at low temperatures, by baking the bread as dry as possible, by rapidly cooling it after baking, by storing it in dry cold and by accelerating its distribution. —J. C. W.

Gels: Action of Light. E. O. Holmes, Jr., and W. A. Patrick. Jl. Phys. Chem., 1922, **26**, 25-41.

Silica gel impregnated with certain organic liquids will, on exposure to ultra-violet light, give off gaseous products provided the liquid can be decomposed photochemically into gases which are not adsorbed by the gel. The gaseous products consist of a mixture of the vapour of the organic liquid with those gases resulting from its photo-chemical decomposition. Celluloid acts in a similar way under the influence of ultra-violet light. The mechanism of the liberation of the adsorbed liquid is explained. These results show in a very striking way the manner in which gas bubbles in the pores affect adsorption, which accounts for the irreversibility of the sulphur dioxide isotherms obtained by MacGawack and Patrick. The embrittling of celluloid is also due to this effect. —J. C. W.

Protoplasm: Coagulation. H. Kahho. Biochem. Zeits., 1921, **120**, 125-142.

An investigation of the coagulating influence of neutral salt solutions on plant plasma is described. Equi-normal salt solutions were allowed to act for a definite time on sections of red cabbage and of *Tradescantia zebrina* and the physiological effects were compared. It was found that the coagulating action of the salt is dependent on both ions, the anion being more significant than the cation. The sequence of the anions, arranged in order of decreasing coagulating power, agrees fairly well with that in the lyotrope series. The differences in the influence of the cations is not as sharply graduated as in the anions. Bivalent cations exert a weaker action than univalent cations. The author discusses the significance of these results. —J. C. W.

Staining of Fabrics; Some Causes of the—with some Remarks on Moulds. E. J. Sidebotham. Jl. Soc. Dyers and Col., 1922, **38**, 97-99.

The discolouration on a piece of printed cotton cloth wrapped on a board and then parcelled in cotton tillot was found to be due to the presence of a fungus (*Botrytis*) which was present in the subcortical part of the wood indicating that the wood had undergone decay. The fungus was obtained in pure culture and found to grow rapidly on damp sterilised cotton cloth, producing the same staining and alterations in the printed colours that had been observed in the damaged cloth. Under 60°F. it grew slowly, but rapidly at 90-100°F. It grew equally well in dyed and undyed portions of the fabric. In a second specimen of bleached calico which had been packed in Hessian union and sent to Mexico it was found that the stains were due to the pitch of the Hessian union. Benzene or similar solvent must have come in contact with the package. —F. C. W.

Starch; The Acetates of——. S. Halen. Chim. et Ind. (from Kunststoffe, 1921, **11**, 121-123), 1922, **7**, 548, and Chem. Trade Jl., 1922, **70**, 513.

The subject of the acetylation of starch is reviewed. Feculose, the product obtained by treating dry starch with acetic acid at a temperature not lower than 120°C., differs from starch by giving on heating with water a clear and stable solution which sets to a soft translucent gelatine-like mass. Feculose is an excellent substitute for gelatine and vegetable gums for dressing in the textile industry and the sizing of paper. The studies on the effect of catalysts on the acetylation process is also reviewed. —L. M. S.

Note on the Moisture Content of Raw Cotton. R. de Ménibus. Bull. Soc. Ind. Rouen, 1921, **49**, 381-399.

Describes the experimental measurements of the moisture content of different samples of raw cotton and shows that very frequently the moisture content is higher than the 8½% regain allowed by the International Congress at Turin (1875). While before the war prices were such that a difference of 2% meant only a very small loss to the buyer, now this is very considerable. It is shown that on the total imports of American cotton into France a difference of 2% in regain would mean a difference of over 14 million francs. The universal adoption of the 8½% regain is naturally strongly advocated. —W. R.

Cellulose; Fluorescent Powers (Spectrofluorescometry) of——Sugars and other Substances (Continued—See This *Jl.* Abs., 1922, **13**, 113). S. J. Lewis. Jl. Soc. Dyers and Col., 1922, **38**, 99-108.

Fluorescent curves for hemp and esparto are almost identical; the cotton curve agrees with these except that the fluorescent power is greater for cotton. Cellulose of widely differing origin possesses the same well-defined fluorescent properties in all regions of the spectrum explored. Flax and ramie form another group. These curves are characterised by a depression between wave lengths 2,400—2,700 and by the ascent from 2,800 towards the visible being less steep than with the first group. Regenerated cellulose (viscose) exhibits no fluorescence; neither does nitrocellulose. Cellulose acetate is strongly fluorescent. The powder exhibits a fairly strong bluish fluorescent glow in toluene at temperatures above 80-90°C. Filter paper soaked in 4% hydrocyanic acid and washed well showed an increased fluorescence. In the present work, a precision of 1% relative to the fluorescence of cellulose is claimed. The distortion of some curves relating to both celluloses and to sugar at a wave length of 2,460 observed in certain cases only would appear to express some special feature of the molecular structure. —F. C. W.

Bleaching Faults in Linen caused by Metallic Impurities. W. Kind. Textilberichte, 1922, **3**, 131.

Bleached linen goods often show small holes which are caused by metallic particles on the fibres acting catalytically on the oxygen evolution, with resultant formation of oxycellulose and consequent weakening of the fibres at this point. These faults show more frequently with linen because of the greater number of boilings and chlorinatings to which it is subjected. Even in cotton yarn, rust spots will cause the tensile strength to drop from 671 g. to 162 g. In chlorine bleaching, metallic iron is more dangerous than the oxide, and copper oxide is more dangerous still. Experiments were carried out to test the effect of metals on the bleach liquor, and the results are tabulated. This type of fault due to metallic particles is characterised by a single thread or only a few threads being affected. The tensile strengths of six threads at a fault are given. To some extent, the bad effects of copper can be diminished by the addition of water glass. —E. B. A.

Tin Weighting in Silk. A. A. Cook. Text. World, 1922, **61**, 2,219.

The writer points out that in his view the usual methods of analysis are too inaccurate. The results he obtained in the ashing determination were anything from 10·8% to 35·8% out. The estimation by specific gravity gave more closely agreeing figures, but should only prove useful as a general sorting test. In the chemical stripping method, using alternate baths of hydrofluoric acid and sodium carbonate, he obtained figures which differed very widely. (Note: Modifications of the last method can be made which yield reasonably accurate results.—F. G. P.) —F. G. P.

Discoloration of Brown Stockings and Gloves by Formaldehyde. R. Linke. Textilberichte, 1922, **3**, 131.

Referring to Ristenpart's article (see This *Jl.* Abs., 1922, **13**, 71) in which the use of formaldehyde free paste in box making or the use of colours fast to formaldehyde is advocated, the writer states that the former is the only sound method, because for leather-brown stockings it is not possible to obtain the correct colour, depth and penetration with dyes which are formaldehyde fast. —E. B. A.

Preparation of Cloth for Finishing: Faults. See This *Jl.* (Proc.), 1922, **13**, 87.

Notes on Oils used in the Textile Industries. See This *Jl.* (Proc.), 1922, **13**, 101.

The Heat Developed by the Action of Caustic Soda on Cotton (" Mercerisation "). See This *Jl.* (Trans.), 1922, **13**, 113.

Ultra-Violet Monochromator. See Section 7F.

PATENTS.

Manufacture of Oxycellulose free from Salts. R. Adler, Austria. G.P.314,311. Appl. 9/1/14. Chim. et Ind., 1922, **7**, 761.

The salts of oxycellulose are mixed with a solvent which has no action on the free oxycellulose (alcohol, ether, acetone) and an acid is added the corresponding metallic salt of which easily dissolves in the solvent used. The mixture is washed with this solvent until the salt is removed, and the free oxycellulose is dried at a low temperature. —L. M. S.

Water Softening. G.P.343,675. Chem. Zentr., 1922, ii, 75.

Water can be softened by treating it with a paste obtained by gelating starch, or plant products rich in starch, with caustic soda. —J. C. W.

7.—BUILDING AND POWER.

(A)—CONSTRUCTION OF BUILDINGS.

Newly Constructed Mills in U.S.A.; Descriptions of——. Text. World, 1922, **61**, 389-435.

Descriptions are given of reinforced concrete buildings with 15,000 spindles and 400 looms; brick buildings on "Ideal wall method," mechanical ventilation; reinforced concrete spooling and thread finishing mills; hosiery shed, 90 by 200 ft., without any pillars; four-storey reinforced concrete mill; brick buildings on foundation of concrete piles; reinforced concrete mill weaving shed, 88 by 170 ft., without any pillars; two-storey brick mill for weaving, dyeing, finishing; reinforced concrete walls, with internal structure of cast-iron pillars and steel girders. —V. M.

Dust in the Textile Industry: Removal of Dust in Flax, Hemp and Cotton Spinning. Textilberichte, 1922, **3**, 138.

A proper dusting plant must fulfil the following conditions:—The dust must be removed at the place of origin; the removal must be hygienic; the dust must be collected and if possible made useful. A description is given of plant built for a flax spinning mill in Hainitz, Germany, both for hand and machine combing, and equipped with the latest dust-removing devices. —E. B. A.

(B)—FIRE PREVENTION.

Fires; Extinguishing Textile Mill——. J. A. Collins. Text. World, 1922, **61**, 69, 81.

The essential features of water supply, pumps, pipes and valves are described, and rules are given for laying out sprinkler systems. For protecting rooms where water in pipes would be liable to freeze, the "dry pipe" system is used, in which the pipes are filled with air at a pressure of, say, 35lbs., and this keeps back water at, say, 100lbs. by means of an automatic differential value. If a head opens, the air pressure drops and releases the water. In addition to sprinklers, small hose pipes are advisable in rooms where there are special hazards; they should be not less than 1½in., preferably of unlined linen, and attached to 2½in. pipes. Standpipes are usually placed in stair towers, and it is important to fit them with hose like that employed by the town fire department. Roof hydrants are desirable where there is a possibility of fire risk to the roof from neighbouring buildings. Last come outside hydrants and hose houses, and advice is given on their proper maintenance. The action and upkeep of portable chemical extinguishers is dealt with. For extinguishing fires in rooms where inflammable dust is present, provision is sometimes made for instantly filling the room with steam. —V. M.

(C)—POWER.

Mixing Coal and Oil. M/cr. Guard. Commercial, 1922, **55**, 402.

Experiments have been carried out with a colloidal fuel made by mixing fuel oil and very finely powdered coal. This fuel is burned in the same way as oil fuel, and has much the same qualities, while its cost approximates to that of coal. —V. M.

Water Power; Evaluation of——in the Textile Industry. Wollen-u. Leinen-Industrie, 1922, **42**, 105.

The German Textile Association recommends the following formula for ascertaining the power used in water motors:— $N = \frac{Q \times H \times F}{100}$, where N = horse power, Q = maximum amount of water usable in litres per sec., H = fall in metres, F = suction depending on the variation in the flow and other disturbing influences This factor F for the utilisation efficiency compared with the full quantity of water available for 250 days' working is 0·6, for 200 days 0·5, for 150 days 0·4, and for 100 days 0·3. If the actual proportion used justifies a still lower factor, this must be specially worked out. —E. B. A.

Boiler and Pipe-Covering Tests. Engineering World, 1922, No.67, 31.

Test results recently published show that slag wool is the most efficient covering material, while 85% magnesia comes next. A 2½in. thickness of slag wool has an efficiency of 96%, and it is unaffected by temperature up to 4,000°F. The 85% magnesia can only be used for temperatures up to 700°F. and its efficiency is 94/95%, while with ordinary plastic pipe-covering compounds the efficiency may be anything between 60 and 85%. —V. M.

Leather Belting; Research on——. E. Rhoads. Text. World, 1922, **61**, 1,549.

The author suggests a number of problems which require further study. The questions of creep and its cause and elasticity have already been studied, and it has been shown that the leather belt is not perfectly elastic in that it comes back immediately after removal of tension, but that there is a time lag which may have some bearing on the problem of power transmission. —J. C. W.

The Economical Production and Use of Steam. See This *Jl.* (Proc.), 1922, **13**, 95.

Neon Tube; Application of——. See Section 6.

(F)—LIGHTING.

Ultra-Violet Monochromator. Z. f. Instrumentenkunde, 1922, **42**, 82-84.

A detailed description of an improved monochromator for ultra-violet light.
—J. C. W.

(H)—HUMIDIFICATION.

Lambrecht Hygrometer. See Section 6.

PATENTS.

Air Humidifier. Robert W. Hardie, West Englewood, N.J. U.S.P.1,404,700, 24/1/22. Appl. 10/8/21.

Humidifying device in the form of a casing with an inlet aperture and a plurality of discharge apertures and having a vapour conditioning member within the casing.
—A.

8.—DESIGN.

Repeating Pattern. P. A. MacMahon and W. P. D. MacMahon. Proc. Roy. Soc., 1922, **101a**, 80-94.

After a short general account of the design of repeating patterns the author establishes a simple method for the design of repeats which leads to a useful classification of these geometrical forms. A calculus for the design of symmetrical repeats is put forward.
—J. C. W.

Dress of To-day and Yesterday in Relation to Colour. Color Trade Jl., 1922, **10**, 47.

A description of dress designs and fashions of the Grecian, Roman, Plantagenet, Elizabethan, Georgian, Victorian and present day, with notes on modern manufacturing and dyeing—adapted from a publication of the Bradford Dyers' Association.
—A. E. G. B.

Leaves from a Designer's Notebook. J. Donaldson. Text. Merc., 1922, **66**, 301.

Reference is made to the production of different weaves in Scotch checked fabrics and the care required to carry the ideas of the designer through all the different processes up to the finished goods. Unfortunately, the efficiency test of pre-war high pressure designing often resulted in the production of 60 to 75% "dud" ranges, but the present cost of making patterns prohibits careless work, therefore every effort should be made to produce designs of a saleable type. Better equipment of designing laboratories is proposed.
—A. E. G. B.

Design in Ancient Peruvian Textiles. T. Cartwright. Text. Merc., 1922, **66**, 321.

A description of the woven decorative fabrics produced with simple spinning and weaving appliances of a primitive type; also of the development of textile design and technique which came during the later periods.
—A. E. G. B.

Design and Finish; Suggestions on——. B. H. Allbee. Cotton, U.S.A., 1922, **86**, 314-316.

Fancy cotton goods cover a wide field which is not entirely occupied in the U.S.A., as shown by the large imports and the growing demand for coloured and figured fabrics. Foreign manufacturers have made fancy cotton cloths a speciality for many years, both in colouring, design, and construction. The colours and designs most wanted are conservative in taste; few high colours and large staring designs are needed, except in certain classes of goods. Soft, subdued colourings and small floral and conventional patterns worked out on new combinations are the general trend, and the reason for this is explained at length, showing how fancy cotton manufacturers are studying their designs more carefully. The copying of silk designs is now being superseded by important design departments in the cotton mills and the purchasing of designs from professional artists. Improvements are suggested in the manufacture of yarns, cloth construction, design and colour.
—A. E. G. B.

Textiles in the New World; History of——. See Section 3G.

9.—COMMERCE, ECONOMICS, LABOUR, ORGANISATION, COSTING, &c.

Canada; Textile Trade Conditions in Eastern——. Bd. of Trade Jl., 1922, **108**, 238.

The Canadian textile trade is said to be recovering somewhat from the acute depression of the last year. Reports received from various parts of the country refer to the important demand for cottons, silks and ribbons. Prices already show a tendency to rise.
—F. C.

United States of America: Cotton Trade of Galveston. Bd. of Trade Jl., 1922, **108**, 264.

During 1921 3,149,230 bales of cotton, worth 253,456,592 dollars, were exported from Galveston. This quantity exceeded the most optimistic expectations. H.M. Consul reports that a considerable revival of trade is now expected, as the Exchange situation has improved and European mills are running short of supplies. Japan is buying a considerable quantity of cotton through Galveston, and there is every prospect of Japanese buyers increasing their purchases in the near future. Great Britain is, of course, by far the biggest customer for southern cotton.
—F. C.

The Work of the National Institute of Industrial Psychology during 1921. Jl. Nat. Inst. Ind. Psychology, 1922, **1**, 49-58.

An account of the investigations and research, vocational guidance and selection carried out by the Institute in 1921. A list is given of the papers sent from the Institute to the International Conference at Barcelona and an account of the relations of the Institute with other bodies. —L. M. S.

Spain; Textile Industry in——. U.S. Commerce Reports, Supp., Spain, 17.

The amount of raw cotton imported into Spain during 1920 was about 81,234,022 kilos, compared with 73,931,092 kilos in 1919. The United States is the principal source of supply; Egyptian cotton is second in favour. The amount of cotton produced in Spain in 1919 was 13,228 bales. The most important of the Spanish manufacturing industries is that of textiles, chiefly carried on in the various provinces of Catalonia. The manufacture of woollen goods is becoming a more and more important industry. —L. M. S.

Active and Idle Machinery in Wool Manufacture, U.S.A. Bull. Nat. Assoc. Wool Mfrs., 1922, **52**, 317.

The report prepared by the Bureau of the Census of the idle and active machinery in wool manufacture for the first quarter of 1922 is presented. Tables are given for each month. —L. M. S.

10.—MISCELLANEOUS.

Colours; The Metamery of——. E. Ristenpart. Leipzig. Monatsch. Text. Ind., 1922, **37**, 78.

The application of Ostwald's colour theory to metameric colours, or colours which appear different in artificial light from what they do in daylight. —E. B. A.

Linen Research Institute at Sorau, Germany. E. Schilling. Textilberichte, 1922, **3**, 118-121.

An illustrated account of the work of the various sections of the Linen Industry Research Institute at Sorau. —J. C. W.

Sampling Atmospheric Impurity. J. S. Owens. Proc. Roy. Soc., 1922, **101A**, 18-29.

An apparatus is described for obtaining a sample of dust from the air for measurement and investigation. It has been designed with a view to microscopic examination of the dust and in order to get an instantaneous value of the quantity of the impurity. It is suggested that it might be used in the examination of expired air to ascertain whether the suspended impurities in the air breathed are retained or expelled, and as a means for rapidly sampling fumes from different sources for microscopical examination. —J. C. W.

Colour Circles. W. H. Thomas. Text. Colorist, 1922, **44**, 241.

A popular description of a new method of colour shading based on the use of a series of circles. —L. M. S.

Treatment of Anthrax-Infected Wools: Failure of the Ultra-Violet Ray Experiment. Wool Rec., 1922, **21**, 1,020.

It is understood that the bacteriologists' examinations (see This *Jl.* Abs., 1922, **13**, 116) show that there is not the slightest indication that sterilisation of the anthrax cultures has been secured by the use of ultra-violet rays. Anthrax bacilli were cultivated rapidly and with ease from the blood clots after exposure to the ultra-violet rays. —L. M. S.

Anthrax; Prevention of——. Text. Merc., 1922, **66**, xx.

Revised regulations governing the importation of wool and hair into Canada are now in force, and aim at the prevention of anthrax. —L. M. S.

ABSTRACTS

I.—FIBRES AND THEIR PRODUCTION.

(B)—ANIMAL.

Skin Wools; Treatment and Use of——. K. O. Lefeaux and S. B. Hainsworth. Wool Rec., 1922, **21**, 889, 961, 1,033, 1,105, 1,177.

An investigation has been carried out at Leeds University to compare the value of skin wools with greasy fleece wools and also the relative merits of sweated and sulphide painted wools. The class of wool skins used in the experiment was a super 64's merino 4-5ins. in length. Equal quantities were treated by the sweating and sulphide painting methods. In the wool scouring, the sweated wool required much more soap and alkali than the painted wool, and was leaner and handled harsher. The colour of both lots was a good white. When Heilman combed, the sweated wool gave a tearage of 14 to 1, as against 11 to 1 in the painted wool. Spinning in both lots was satisfactory, the sweated wool producing a more compact yarn and a less full handling finished cloth. Finally, it is stated that painted wool is superior to sweated wool and practically equal to greasy wool for cloth manufacture, and may be used alone in producing first-class cloth. —F. P.

Dyed Silks; Cause of Nibs and Lousiness in——. See Section 6.

(C)—VEGETABLE.

Sulphur Spray. E. Vogt. Rev. App. Mycology (from Nachrichtenblatt f. den deuts. Pflanzenschutzdienst, 1921, 1-4, 29), 1922, **1**, 29-30.

A handy, portable apparatus designed by Rupprecht, for applying sulphur to plants is described. Roll sulphur, contained in a small iron pan, is melted and boiled by a spirit lamp which heats, at the same time, a circular copper boiler containing water. The strongly superheated steam of the latter is forced under high pressure through the boiling sulphur and vapourises it into small mist-like drops. In consequence of the sudden cooling in the open air, the little drops of sulphur do not harden immediately. This plastic sulphur possesses a high degree of adhesion. The apparatus possesses many advantages, but while always successful in closed spaces it can only be used in the open air in calm weather. —J. C. W.

Flower Bud: Self Fertilisation. C. and A. L. Hagedoorn. Genetica, 1922, **4**, 64-69.

A technique for closing flower buds by means of lead wire for purposes of studies of self-fertilisation is described.—J. C. W.

Cotton Pest. Rev. App. Mycology (from Phytopath., 1921, **11**, 48), 1922, **1**, 59.

A hitherto unreported disease of cotton in Arkansas appeared in 1920, and made very rapid progress during a period of cool, wet weather. All plants were killed in small patches in severe cases; in others, the stand was greatly reduced. A change in weather conditions abruptly checked the progress of the disease, and many plants recovered. Scars of the lesions caused by the disease were found throughout the summer. The parasite, a species of *Phoma*, was isolated, and successful inoculations obtained both in wounded and unwounded tissues. All parts of the plant above ground can be attacked and extension in the tissues is very rapid, but a high degree of humidity is essential for the activity of the fungus. —J. C. W.

Cotton Pest. F. Vincens. Rev. App. Mycology (from Official Report, pp. 19), 1922, **1**, 160.

In a summary of some work carried out at the Phytopathological Laboratory of the Scientific Institute of Indo-China, it is stated that cotton leaves submitted for examination from Cambodia were found to be affected simultaneously by the insect *Sylepta derogati* and the fungus *Ramularia areola*, producing the disease known as "false mildew." *R. areola* also occurred on imported varieties of cotton in the Botanical Garden of Saigon, but left the indigenous varieties practically unharmed. Anthracnose (due to *Glomerella gossypii*) and a canker of the collar, the cause of which was not determined, were also seen in Cambodia. *Mycosphaerella gossypiella* is recorded as a leaf-spotting fungus, but does not cause appreciable damage. —J. C. W.

Blue Stain Cotton; Bleaching——. Dyer and Calico Printer, 1922, **47**, 188.

A method has been invented for bleaching blue bender, blue Texas, or blue stain cotton, but no description is given. The stain in this cotton is said to be caused by glacial deposit in the alluvial soil in the delta region. When cotton is left in the boll too long after maturity it turns blue, and sells for less than the upland cotton of the same strength and staple.—J. C. W.

Sulphur Spray. G. Rupprecht. Botan. Zentr. (from Angew. Botanik, 1921, **3**, 253-262), 1922, **143**, 189.

Further details are given of Rupprecht's process for applying sulphur. It is stated that for greenhouse purposes 0·6—1·0 grms. of sulphur per cu. metre is required, and in the open air 1 kg. per hectare. The addition of 0·5% of realgar renders an application of the insecticide effective for some weeks. —J. C. W.

Soil: Moisture Content. B. A. Keen. Trans. Faraday Soc., 1922, **17**, 228-243.
A discussion of the relation of the soil to its moisture content in which a comparison is made between the original hypothesis and the modern one. It is shown that the colloidal material in the soil exercises a profound effect on the moisture relations, and that these relations are continuous over a wide range. The majority of the various sub-divisions and equilibrium points which were developed on the older hypothesis are not to be regarded as having any deep physical significance, and in one or two cases their interest is physiological rather than physical. The author regards further progress of the knowledge of the moisture relations in soil as most likely to follow if its colloidal properties are taken into account. —J. C. W.

Liming as a Means of Soil Amendment. F. Hardy. West Indian Bull., 1922, **19**, 161-189.
A general account of liming as a means of soil amendment is given under the following headings:—(1) The various effects which liming exerts on soils and the inter-relationships between them; (2) the effect of liming on soil texture and soil reaction; (3) liming to correct deficiency in calcium in certain soils; (4) the antagonistic effect of calcium ion in the soil solution; (5) the effect of liming in precipitating certain toxic substances in the soil solution; (6) the possible indirect fertilising effect which lime may bring about in causing an exchange of ions when added to soils; (7) the measurement of the lime requirements of soils; (8) soil fertility and reaction. —J. C. W.

Flax Retting Process; New——. R. L. Pritchard. Text. Merc., 1922, **66**, 492.
In Dr. Pritchard's method, the raw flax is first put through a machine which separates the fibre; after the fibre is separated a gum remains, which is removed by soaking in vats containing soap and water at a temperature of 110°, the process occupying only five hours. It is possible to preserve the seed, which is lost in the present process of manufacture, and also to save the wood, which contains 77% cellulose. Dr. Pritchard suggested that one of the uses to which this process might be put was to provide the " mixture " for shoddy in the Dewsbury trade, flax having definite advantages over cotton for this purpose. Fibre produced by this process dyed the same as cotton fibre, and was bleached with great facility and without any deterioration. The objectionable stench associated with retting pits was completely avoided, and the process could be applied, with some modification of the machinery, to both ramie and jute. —L. M. S.

Frequency Equation; Modification of——. See Section 6.

Humus; Function of——. See Section 6.

(D)—ARTIFICIAL.

Acetylation of Cellulose. See Section 6.

PATENTS.

Artificial Filaments; Films. British Cellulose and Chem. Mfg. Co., and C. W. Palmer and W. A. Dickie, Spondon. E.P.177,868, 4/4/22.
The filaments or films are prepared from cellulose acetate solutions, in particular the solutions in acetate, by coagulating the formed filament or film in a bath containing a thiocyanate such as ammonium, potassium, sodium, or calcium thiocyanate. By this process the filament, etc., it is claimed, is of improved strength and elasticity and granulation is avoided, whilst in the case of filaments it is possible to employ large spinning orifices and to draw out the filaments to the fineness of natural silk. Plastifying agents and other additions may be added to the cellulose acetate solution. —A.

Imitation Wool; Production of——. F.P. 528,465. See Section 4.

2.—CONVERSION OF FIBRES INTO FINISHED YARNS.

(A)—PREPARATORY PROCESSES.

Nep. Cotton, U.S.A., 1922, **86**, 323.
During a discussion on pickers, at a meeting of the Southern Textile Association, it was stated that there is more nep in cotton which has passed through the opening machinery than there was before. Much nep occurs as the result of careless ginning. Nep in yarn depends a great deal on how many times the cotton is beaten, and how fast it is fed to the opener. —J. C. W.

Cleaning Soft Cotton Waste. S. Wakefield. Text. Rec., 1922, **39**, 62.
A description is given of a machine, recently patented, which will remove foreign matter from card fly, etc., and deliver the cotton in a spinnable condition. The process is in effect one of combing the fibres, thereby rubbing them clean. The principle of the machine is adaptable to other purposes and should prove of use to hard waste spinners in the removal of very short, hard ends and for other similar requirements. —J. C. W.

Creighton Openers; The Tandem Use of—. J. Robertson. Cotton, U.S.A., 1922, **86**, 393.
The author recommends the use of Creighton openers in tandem for picking and cleaning. By this means good cleaning and opening are combined with thorough mixing and airing, and quick conditioning of the cotton. The amount of waste extracted by Creighton openers in tandem varies with the different makes and speeds of beaters, together with the use of grid bars or of perforated metal screens. —J. C. W.

Cloth; Manufacture of——. B. Garten. Textilberichte, 1922, **3**, 83, 102.
The first article deals with the choice of the raw material, and tabulates the varieties suitable for various classes of cloth bearing a stripe. The second article gives similar information for cloths without a stripe. —W. E. B.

Flax Retting Process; New—. [" Mixture for Shoddy."] See Section 1C.

Cloth Manufacture; General Remarks on—. See Section 4B.

(B)—SPINNING AND DOUBLING.

Spinning Carded Yarns on the Ring Frame. W. Meister. Textilberichte, 1922, **3**, 87.
Illustrations and a description are given of a machine built at Bielitz. The difficulty consists in making the untwisted yarn withstand the action of the ring spindle. The method is to interpose between the pairs of draft rollers a so-called " spinning tube," which imparts a twist before the yarn passes through to the spindle.
—W. E. B.

Simplex Knotter. Text. Rec., 1922, **39**, 56.
This is a simple device of which the parts are comparatively few in number. It differs from the Barber knotter in that it does not release the clamped yarn at the bottom of the thumb piece stroke. The thumb piece must be allowed to return to its upward or operating position. Many of the parts are made of sheet steel, and the device is very light. —J. C. W.

Speciality Yarns. J. W. Kershaw. Text. Rec., 1922, **39**, 75.
Novelty cotton yarns are produced by making departures from the usual specifications in colour, twist, direction of twist, and strength. They are also made by introducing imperfections into the yarn, such as:—(1) Yarns spun as irregular as possible to show thick and thin places; (2) nep yarns sometimes spun with white neps on a coloured ground; (3) slubs introduced by means of a special mechanical arrangement. In the case of doubled yarns, numerous styles of effect yarns can be produced on comparatively simple doubling machines by utilising the expansion and contraction of threads of equal or unequal counts according to the amount and direction of twist. In all of the varieties, artificial silk threads or coloured threads can be introduced.
—J. C. W.

Mule Frame. R. Taine. L'Ind. Text., 1922, **38**, 154-157.
The author compares various systems of control on mule spinning frames, including:—(1) Intermittent rotation driving shaft; (2) continuous rotation driving shaft; (3) electric control by individual motor. The article is to be continued.
—J. C. W.

The Flyer and its Calculations. H. Bruggemann. Textilberichte, 1922, **3**, 3, 23, 46, 66, 102.
This series of articles provides a careful mathematical analysis of the mechanism of those cotton-spinning machines which incorporate a flyer. The first article describes the conventions which are used to simplify the illustrations and analysis and also describes the general action of the slubber. Succeeding articles deal fully with the elements of the best-known types of machines. —W. E. B.

(D)—YARNS AND CORDS.

Twist in Yarns. La France Textile, 1922, No.5, 224.
Much discussion has arisen on the question as to whether the length of a piece of yarn is the same for the same number of turns per inch, whether it has left or right handed twist. The two methods whereby the twist in yarns is tested are discussed, and it is shown that the results so obtained are in both cases inaccurate, and, in order to render them more accurate, the results obtained should be multiplied by a certain constant. This constant varies with the class and counts of yarn, and each mill should find for itself by a series of experiments and observations the co-efficient or constant which gives the truest results for their class of work. A device is described which can be adapted to most of the ordinary makes of twist testing machines whereby more accurate readings can be obtained, but even these readings must afterwards be modified by the use of a co-efficient. It is suggested that when spinners receive orders for yarns to sample, instead of finding their turns per inch and so reproducing them, they should try to obtain the same degree of resistance and elasticity as the sample yarns, irrespective of the twist, as these are the factors which concern the weaver most. —A. H. M.

Speciality Yarns. See Section 2B.

PATENTS

Stop Motion for Self-acting Mules. E. Bullard. F.P.520,897. Appl. 21/7/20.
An arrangement for stopping self-acting mules whereby the belt is replaced from the fixed pulley to the loose pulley when the pirn winding is finished in order to avoid winding an excess of yarn.
—Bur. Text.

Spinning; Spindle-driving Apparatus. J. Higginson and Arundel, Coulthard and Co., Ltd., Stockport. E.P.178,561, 19/4/22.
The arms carrying the tension pulleys of the spindle-driving bands of yarn or thread-doubling and like machines are arranged so that the pulleys may be simultaneously re-positioned when the lead of the bands is altered to reverse the direction of rotation of the spindles.—A.

Spinning: Doubling and Twisting. F. Ainsworth, Blackpool. E.P.178,610, 27/4/22.

In a device for doubling or twisting yarns, the doubled yarn passes around a driven tapered spindle arranged between the delivery spindle, which carries a plate provided with eyes through which the single yarns pass from the bobbins thereon, and the winding-on spindle or bobbin guides are arranged to lead the yarn to and from the driven tapered spindle around which it is coiled and by which it is tensioned and stretched. —A.

Preparing Fibres for Spinning: Opening and Mixing. F. Stringer, Kirkstall, Leeds. E.P.178,487, 4/4/22.

Cotton, wool, etc., are opened by a machine comprising feed-rollers, taker-in, preparing roller, cylinder co-operating with workers and clearers, a second cylinder, and a brush to remove the fibre from the cylinder and transfer it to a trunk provided with dust cages, or to a lattice. The workers and clearers are covered with card wire of double convex or round or oval section, and the remainder of the rollers with garnett wire. By feeding two or more superposed laps of different materials, fibres may be mixed by passage through the machine. —A.

Artificial Filaments; Staple Fibre. W. P. Dreaper, London. E.P.178,481, 10/4/22.

To obtain skeins of artificial silk, etc., directly and to obviate re-winding, the threads from the spinning machine are collected in a centrifugal box of sufficiently large diameter to form a skein, whereupon the coils are secured at intervals, for example, by cross-lacing or by clips, and the skein is then removed from the box and treated as is usual in the manufacture of artificial silk and finally cut up to form staple fibre. —A.

Spinning: Doffing Arrangements. W. Binns and J. D. Mander, Bingley. E.P.178,478, 24/4/22.

In spinning, roving, and like frames, fixed guides are provided to engage and co-operate with mechanism for operating upon the caps and bobbins which is carried upon the ends of levers depending from a frame displaceable on overhead runways to serve different parts of a spinning frame or different frames of a bank of spinning frames. The doffing mechanism is displaced and lowered into operative position in the manner described in Spec. 136,861. —A.

Vacuum Stripping of Cards. Kestner et Neu. F.P.442,285. Appl. 3/3/20.

The apparatus used for vacuum stripping is placed above the iron plate covering the doffer in the vicinity of the vertical plane passing through the axle of the latter. It is thus possible to pull down the covering of the large cylinder of the card without taking off the apparatus. —Bur. Text.

Artificial Threads; Films; Viscose. Snia Soc. di Navigatione e Commercio Reparto Viscosa—Turin, Italy. E.P. 178,121, conv. 7/4/21.

Threads, ribbons, films, etc., from viscose are obtained of improved quality by employment of coagulating baths in which the organic by-products formed during the coagulating process have accumulated. The baths are withdrawn from the apparatus, are concentrated and cooled to separate out mineral salts such as sodium sulphate or formate, and are then returned to the apparatus. —A.

Preparing Fibres for Spinning (Openers). Platt Bros. and Co. and H. Wilkinson, Oldham. E.P.177,017, 23/3/22.

Relates to improvements in a lattice feeding machine for opening cotton, etc. —A.

Spinning: Spindle Apparatus; Doffing Arrangements. J. and R. W. Edge, Southport, and F. Barlow, Hyde. E.P. 177,182, 14/3/22.

In ring-spinning, ring-doubling and like machines, the yarn after leaving the rollers passes around the spindle in one or more coils to a freely floating guide which reciprocates relatively to and rotates around the spindle, and is capable of movement radial thereto, and thence back to the spindle on which it is wound in cop form. The spindle is longer than usual, so that at any stage of the winding a bare portion extends above the cop.—A.

Artificial Fibres. W. P. Dreaper, London. E.P.178,151, 6/4/22.

For the manufacture of "staple fibre," a large number, say 200, of untwisted spun filaments are formed into a composite strand in which the filaments are arranged in a parallel and ordered fashion; the strand is then led directly from the precipitating bath to a winder on which it is cross-wound to form a skein; and, after drying under tension either on the winder or after transfer to a separate stretching frame the skein is cut up into lengths. Being in ordered and parallel fashion, the fibres are particularly suitable for manufacture of yarn either of these fibres alone or mixed with other textile fibres. The filaments, at the exit end of the precipitating bath, are collected and distributed in even and open manner to the winder; the full-sized skein so produced is preferably at once cross-laced in three equi-distant places, and preferably whilst still in the winder is washed, dyed, etc. —A.

Preparing Fibres for Spinning; Feeding Openers, etc. J. Law, Bury. E.P. 178,280, 20/4/22.

Means are provided to free the feed-rollers of a hard-waste breaking machine, to allow of reversal by hand of any of the pairs in order to remove any hard foreign substance being fed. —A.

Preparing Fibres for Spinning: Openers. J. Forkin (Bury) and A. Bannister (Westhoughton). E.P.178,470, 11/4/22.

In apparatus of the type in which the cotton, cotton waste, etc., is fed by feed-rollers to a licker-in by which it is transferred through a shoot to a revolving perforated cylinder with a damper at one side to allow the collected fibres to be removed, an additional card-covered or toothed roller is provided to straighten the fibres as they are acted on by the licker-in. —A.

Spinning: Spindle. H. A. Tiffany. Paterson, N.J., Assr. to Buckley Son Inc., Delaware. U.S.P.1,414,905, 2/5/22. Appl. 19/3/21.

Provides particularly for effective lubrication by the combination of a bolster having an upright bore closed at its lower end and an interior lubricant groove. —A.

Combing Machines; Improvements in——. C. Verstraete. F.P.520,837. See E.P. 166,892, This *Jl.*, 1921, **12**, 441.

3.—CONVERSION OF YARNS INTO FABRICS.

(B)—SIZING.

Amylase; Activity of——. See Section 6.

Starch: Fermentation. See Section 6.

(C)—WEAVING.

Double Lift Dobbies. L'Ind Text., 1922, **38**, 170.

In order to make double lift dobbies work easier, Mr. Pidoux has tried to do away with all the unnecessary movements and to ensure their remaining in a fixed position as long as they are required to remain unaltered. Under present conditions, there is much time lost with these double lift dobbies at the changing of the hooks on the blades, and this changing gives a certain downward motion to heddles which actually have to remain at rest. This is the cause of shocks, etc., which are detrimental to smooth working and also give extra work to the minder. The present actuating of the knives by the crank-arm and crank is substituted by cams which act either directly or through levers on to the arms of the knives. —A. H. M.

Weaving; Greater Accuracy in Coloured—Calculations. E. Rüf. Textilberichte, 1922, **3**, 68.

The present high cost of raw materials necessitates greater accuracy in calculating the weights of weft and warp used in weaving. The author quotes two examples from practice where the differences between calculated and actual weights were 11% and 3·5% respectively. The difficulties and relevant factors are then enlarged upon. —W. E. B.

Narrow Woven Goods; The Manufacture of——. F. Klages. Spinner u. Weber, 1922, **40**, No.16, 2.

The author describes the machines involved and pleads for immediate and radical improvement therein by the development of specialists with both mechanical and textile training. —W. E. B.

Plush and Carpet Weaving with an Illimited Number of Shades. L'Ind. Text., 1922, **38**, 166.

An invention is described whereby plush or carpet weaving can be carried out on the usual power loom. All the yarns which form the plush are ends of even length; if these are pulled out one by one in their order and fixed end to end to each other, a plush warp yarn is obtained which when woven gives the original carpet design with its various shades. The means whereby this multi-coloured warp is obtained in practice is explained. —A. H. M.

Weaving Cloth with Stripes and Selvedge cross-wise. L'Ind. Text., 1922, **38**, 168.

Generally in these classes of weaves the stripes cross the selvedge, but a method is described whereby the stripes no longer cross the selvedge, and in this case the coloured picks corresponding with the stripes have to be prevented from working in the selvedge. The mechanical appliance to obtain this result is described and illustrated. —A. H. M.

Cloth Building; A Practical Treatise on—. W. Law. Wool Rec., 1922, **21**, 968 to 1,486 (series).

In the preliminary experiments, a 2-40's worsted yarn with 14 turns per inch of 64's quality was used, and cloths were woven employing plain twill, hopsack, and sateen weaves. When the length of float is increased it is found that the threads become displaced, allowing more ends and picks to be used than if they remained alongside each other. A graph shows the effect of this displacement on the various weaves used with different floats. Further experiments were made with weaves with longer floats in length than width—including warp cords, warp corkscrews, warp whipcords—and with weaves with longer floats in width than length, including weft cords, weft corkscrews, etc. A table of weave values is given whereby the diameter of the yarn reciprocal multiplied by a certain number gives the set and picks for a square cloth. Experiments to produce cloths with various counts of yarn from a standard firm cloth as basis were carried out, and also others where there are combinations of worsted warp and woollen weft, silk warp and worsted weft, and cotton warp and woollen weft. Rules are given for obtaining counts and set for worsted cloths, a 2 and 2 twill worsted coating set 10% under the maximum, blankets and Meltons. —F. P.

The Beltless Reed Motion. Textilberichte, 1922, **3**, 100.

The application of the Wolfrum beltless reed motion to a new loom made in Chemnitz is described and illustrated. —W. E. B.

Loom. A. M. Chapman. Jl. Huddersfield Text. Soc., 1920-21, **18**, 38-44.

The author discusses the mechanism of the loom, and indicates a number of improvements which would be highly desirable. The advantages and peculiarities of certain types of shedding, including bottom, centre, open and semi-open types, and some problems relating to setting and timing are discussed. —J. C. W.

(D)—KNITTING.

Needles; The Inspection of——. Worm. Textilberichte, 1922, **3**, 29, 50, 70.

In three articles, the author describes the factors which influence the final performance of the needles. The first article deals with the checking of the needles as received from the maker and gives card-index forms used for tabulation; the second article describes the inspection before setting to work in the machine, and the third discusses the points to be watched after the needle is in position. —W. E. B.

Machine Knitting. W. Meister. L'Avenir Text. (from Le Moniteur de la Maille), 1922, **4**, 345.

In order to determine the gauge of a machine for a certain class of work, the count of yarn to be used must be considered. The relation between the counts of yarn and the guage of the machine is dependent on the experience of the worker and is therefore liable to much variation. This variation is considered mathematically with a view to obtaining a simple formula, which when applied in practice will give the desired results. An equation is worked out which proves that the length of mail is dependent on the thickness of yarn used and also on the distance between two needles. An equation is also given for finding the quantity of yarn required for a certain work. —A. H. M.

Circular Fabric Machines; The Efficiency of——. W. Zöllner. Textilberichte, 1922, **3**, 91.

The writer equipped two of his machines with revolution counters. By comparing the calculated number of revolutions with the actual, the percentage efficiency of working can be obtained and plotted on charts, hourly and daily. Examples are given. W. E. B.

Harmony and Defects of Colour Combinations. Textiles (from Le Moniteur de la Maille), 1922, **20**, 20.

A chart is given showing the effects obtained by a combination of different colours as a guide for designers of knit outer garments where the colour of the ground work is different from that of the collars, belts, or trimmings. —L. M. S.

Lubricant; The Choice of——for Knitting Machines. See Section 7D.

PATENTS.

Braiding Machines. H. Wade, London firm of Krenzler, Barmen, Germany). E.P.178,390, 20/4/22.

Relates to lace braiding machines in which each bobbin-driving plate is rotatable in either direction as determined by the selection of a jacquard. —A.

Looms: Lubricating for Letting-off Mechanism. H. Weston and G. Robinson, of Bingley and Allerton. E.P. 177,210, 7/3/22.

In letting-off mechanism for looms, of the kind described in Specifications 1,064/78 and 21,573/01, lubricating means are provided between the brake blocks or shoes and the hooped ends of the beam. Each block or shoe, or each contact section, is packed with a central recess packed with yarn grease or cotton waste saturated with oil, and grooves are provided running parallel to the sides or ends of the blocks, or converging towards the centres of the recesses, or a combination of both. —A.

Sewing Mechines: Defects in Pile Fabrics. H. P. Taffin, Roubaix. E.P.177,535; Conv. 25/3/21.

The shuttle is replaced by a thin loop-detaining hook and the machine used for inserting free loops in defective parts of pile fabrics. The hook may be sharpened for loop cutting. —A.

Lace Machines; Twist——. W. Coombes and F. W. Pare, Nottingham. E.P. 177,555, 3/4/22.

Relates to means for introducing weft threads between the warp and bobbin threads at any desired phase of motion. —A.

Looms; Stop-motions, Weft——. W. B. White, Colne. E.P.178,219, 19/4/22.

A weft-fork holder is formed with a spigot which enters a socket in the shank of the weft-fork holder, and is prevented from turning upon the shank by a portion which enters a slot in the wall of the socket or by a pin passing through the socket and spigot, endlong movement of the holder being prevented by the pin or by turning a portion of the end of the socket over the end of the holder. Modification is provided for, and Spec. 160,991 is referred to. —A.

Split-work Knitting Machine. A. Landry, Central Falls, R.I. (Assr. to Hemphill Co.). U.S.P.1,415,583, 9/5/22. Appl. 5/2/19.

A machine with main and auxiliary feeds having the auxiliary set of knitting cams located at an entirely different level from that of the main knitting cams. —A.

Looms: Loose-reed Motions. P. Inman, Earby, Lancs. E.P.178,350, 20/4/22.
A guard and its heater are combined in one unit and are adapted to be secured to any existing heater-bracket. —A.

Lace. W. Coombes and F. W. Pare, Nottingham. E.P.178,596, 27/4/22.
One or more weft threads are laid within a shed formed from the warp threads and bobbin threads of a twist lace machine, in such a manner that, at the places where the wefts are locked in, the warps exert equal and opposite forces on the bobbin threads, thereby preventing distortion of the latter and reducing the tendency of the fabric to unrove. —A.

Picker for Loom. O. Boulanger. F.P. 520,864. Appl. 26/7/20.
The structure of a leather picker for underpick is described. —Bur. Text.

Loom. E. J. Wilson, East Greenbush, N.Y., Assr. to Huyck and Sons, New York. U.S.P.1,415,286, 9/5/22. Appl. 23/5/21.
A loom having, in combination, a lay, an endwise reciprocating actuating bar parallel thereto, and a series of adjustable connections connecting the bar with the lay at intervals throughout its length.—A.

Knitting Machine Needle. J. C. Egly, Philadelphia, Pa. U.S.P.1,415,322, 9/5/22. Appl. 13/3/20.
Has a flexible portion in proximity to the butt, formed by removing a portion of the wall on opposite sides of the needle and bent at the flexible portion to give the proper friction when in use in a needle cylinder. —A.

Bacteria Diastase: Application. G.P. 349,655. See Section 4.

4.—CHEMICAL AND OTHER PROCESSES.

(B)—SCOURING AND DEGUMMING

The Oval Wool Washing and Scouring Machine. K. Saur. Textilberichte, 1922, **3**, 86.
Illustrations and a description of the machine are given, including the agitator gear and the arrangement for automatically lifting the wool out. —W. E. B.

Cloth Manufacture; General Remarks on——. Dr. von Kapff. Textilberichte, 1922, **3**, 81.
The properties of raw wool suffer continuously at each stage of manufacture into finished goods. Hence, Dr. Jäger made his rule that as few processes as possible were to be used. The washing, carbonising, dyeing, carding and oiling all have effects which are discussed, as also the water and the handling of the material. —W. E. B.

Fastness of Dyed Wool and Silk to Fulling, Scouring and Washing; Provisional Method on——. See Section 6.

Soap Solution: Detergent Power. See Section 6.

(C)—WASHING.

Fastness of Dyed Wool and Silk to Fulling, Scouring and Washing; Provisional Method on——. See Section 6.

(D)—MILLING.

Fastness of Dyed Wool and Silk to Fulling, Scouring and Washing; Provisional Method on——. See Section 6.

(E)—DRYING AND CONDITIONING.

Drying on Hot Air System; Method of—. A. Legrand. L'Avenir Text., 1922, **4**, 291.
Describes a new method of drying which is applicable to many textile machines. The fabric to be dried is passed through a narrow gap between two vessels, one of which has a convex face and the other a corresponding concave face in contact with the material. These faces are perforated, and heated air, blown into one vessel and exhausted from the other, passes through the perforations and through the fabric and dries it. Advantages are claimed as to control of the drying operation, cost, removal of the saturated air from the workroom, and the possibility, in the treatment of coloured fabrics, of obtaining uniform temperature on both sides of the fabric and effecting oxidisation in the body of the fabric.
—V. M.

Drying Room; The Modern Mechanical—. Textilberichte, 1922, **3**, 186
An up-to-date drying room is provided with an overhead runway along which travels the carrier for the goods. These are loaded at the entrance, and require no further handling until they arrive at the unloading station. The carrier is mechanically propelled, travels to the end, and returns down the other side. The speed can be regulated to suit the degree of drying required. Ventilation is either by natural means through roof ventilators or by means of exhausters. —E. B. A.

(F)—CARBONISING.

Cloth Manufacture; General Remarks on—. See Section 4B.

(G)—BLEACHING.

Bleaching of Flax. R. Buratti. Avenir Text. (from L'Industria Tessile e Tintoria), 1922, **4**, 301.
The bleaching of flax is more complicated than that of cotton, because it contains 30% non-cellulose. The complete removal of these bodies is made difficult by the weight of the fibre, and the suppleness

and tenacity, which depend on the fatty matters. In the complete or Irish bleach, the bleached fibre consists of almost pure cellulose. Ordinary bleaching aims at decolorisation of the impurities rather than their removal. Creaming is obtained solely by decolorisation. The degree of bleaching is only moderate, and the loss of weight amounts to only 5—8%. The operations in the bleaching of flax thread for sewing thread are fully described. The loss in weight is 12·25%. In bleaching thread for weaving, two lye boilings are recommended before treatment with chlorine, and the latter only repeated three times. In creaming, the lye boiling is reduced, and only one chlorine treatment is given. —E. B. A.

The Bleaching of Silk. A. Ganswindt. Textilberichte, 1922. **3**, 183.

Silk withstands treatment with aqua regia; used in a 3°Bé solution, cold, the yellow colouring matter of the silk is destroyed; the silk must be washed immediately, otherwise a yellow colour developes which cannot be removed. This method has been used in Lyons for over 69 years; it is only suitable for Souple and Ecru silks. Sulphurous acid is the chief reagent used, either as gas, solution, or sodium bisulphite. In practice, gaseous sulphur dioxide is most advantageous. The damp skeins are hung in the bleaching chamber for 24—30 hrs.; the colouring matter is converted into a water soluble leuco compound which must be well washed out. Unfortunately, there is a residue of sulphur left on the fibre, but the method is very cheap. Hydro-sulphite of 3°Bé acidified with 1% acetic acid is used. Where a leuco compound is formed, there is always danger of reoxidation and colour formation unless the washing is very thorough. By using peroxides, the colour is actually destroyed and this danger avoided. Sodium peroxide in faintly alkaline solution at 55°C. is best. Sodium perborate acidified with citric or formic acids is dearer, but more stable metals must be avoided. —E. B. A.

Blue Stain Cotton; Bleaching——. See Section 1C.

(I)—Dyeing.

Katanol; A New Tannin Substitute for Mordanting. Guenther. Textilberichte, 1922, **3**, 209.

Katanol has been introduced as a complete substitute for tannin. It goes directly on to cotton and forms an insoluble compound which does not wash off. Details are given for its use. The colours obtained are very similar to those with tannin; the fastness to washing is better, and to light equal. If used for unions, the goods are mordanted cold, the wool being unaffected, dyed cold with basic dye, the cotton only taking the colour, then by adding more acetic acid and raising the temperature not above 80°C. the wool also is dyed. This is not possible with tannin, which resists the wool. —E. B. A.

Indanthrene Dyes. Text. Colorist, 1922, **44**, 312.

Some hints are given on the application of indanthrene dyes. It is stated that the most important part of the process is the ageing. The ager should be placed as near to the boiler as possible and on the same level. The piping system between the boiler and ager must be arranged in such a way that it is independent of other steam pipes of the plant. The low pressure steam should be saturated with water so that the goods always receive sufficient moisture during the time that they are in the ager. Irregularities in the results are always caused by qualitative or quantitative changes in the nature of the steam, such as may be caused by stopping up the steam pipes by rust or dirt. —J. C. W.

Dyeing Process; New——. Chem. Age, 1922, **6**, 554.

A class of dyes called ionamines has been developed from Primuline; they will only dye silk, either real or artificial, having a good affinity for acetyl silk. By mixture of these dyes with others cross dyeing of cotton goods with effect threads may be accomplished. —F. G. P.

Warp Dyeing; Some Experiences with Uneven——. W. F. Haskell. Amer. Dyestuff Reporter, 1922, **10**, 339.

The failures of machinery and errors in the use of the necessary chemicals and dyestuffs are said to account for a large number of uneven dyeings in chain dyeing. Dyes of poor solubility are very apt to cause streaky dyeing in beam dyeing machines. —L. M. S.

Light; Physiological Action of——. See Section 6.

Dye: Fastness. See Section 6.

Dyed Silks; Cause of Nibs and Lousiness in——. See Section 6.

Fastness of Dyed Wool and Silk to Fulling, Scouring and Washing; Provisional Method on——. See Section 6.

Shady and Cloudy Goods; Causes of——. See Section 6.

Cloth Manufacture; General Remarks on——. See Section 4B.

(J)—Printing.

Textile Printing Machine and its Drive. Text. World, 1922, **61**, 27, 33.

A description of the methods and difference between fabric printing, dyeing and engraving of designs on to copper rollers; also describes how large floral patterns with eight or ten colour combinations are prepared by means of the pantograph machine process. Output, power required for driving the printing machine, and a description of four principal methods of driving in use to-day are explained and illustrated. —A. E. G. B

(K)—FINISHING.

Raising Machine. T. W. Riley. Text. Rec., 1922, **39**, 55.

An improved 36-roller raising machine, 80 inches wide, is described. Friction has been reduced to a minimum. The usual style of rocker arms forming parts of the plaiting motion are carefully balanced, weights being employed. It is claimed that balancing of this character puts less strain on the cloth-cone belt so that the cloth is under better control while passing over the card rollers on the cylinder, and the erratic or jerky action of the plaiting motion is eliminated. One wide belt is employed for driving the card rollers, and this encircles the whole of the card-roller pulleys. The method of fixing the gearing on the brush roller shafts is an important feature of the machine. —J. C. W.

PATENTS.

Degumming of Fibres. M. Sabner, Prestwich, Manchester. E.P.178,570, 20/4/22.

In degumming fibres, such as jute, ramie, and flax, the material is treated with chemicals, steamed, and washed whilst in an open condition and without handling. The apparatus consists of a kier or vessel having a removable frame containing a number of chests spaced apart, each chest communicating with a central supply pipe or conduit carried on the frame and having outlet apertures on its lower side. Trays, having perforated bottoms, are supported between the chests so that the steam or fluid from the chests is directed downwards on to the material in the trays.—A.

Bleaching of Textile Yarns and Fabrics. Cate, Zonen and Mohr. F.P.521,875. Appl. 10/7/20.

In bleaching with chlorine and oxygen a boiler is filled with the material for bleaching and the bleaching liquor, closed, and subjected to a pressure of 2 or 3 atm. The method of circulating the liquid is described. —Bur. Text.

Cotton Fabric; Bleaching——. E. Forbes, Webster, Mass. U.S.P.1,401,901, 27/12/21. Appl. 19/3/20.

Cotton fabrics are bleached by treatment at 20°C. with a solution containing bleaching powder, sodium carbonate, and sodium silicate in given proportions. —J. C. W.

Weighting of Silk and other Fibres. L. M. Wohlgemuth. G.P.312,301, 1/9/16. Jl. Soc. Chem. Ind., 1922, **41**, 289A.

Fibres are weighted with hydroxide of boron, zirconium, titanium, or thorium, or a basic silicate and then treated with salts capable of forming adsorption compounds with the former. For example, silk is treated with zirconium chloride, steamed or dipped in alkali to precipitate hydroxide, then with basic zinc sulphate. The process enables fibres to be weighted with metals for which they have but little affinity. —F. G. P.

Printing Silk and Cotton. C. P. A., Ltd., Manchester, and G. Nelson, Hyde. E.P.177,926, 13/4/22.

A process consists in (1) mordanting the fabric with a chromium mordant, (2) dyeing with a dyestuff appropriate to the mordant and known to be affected by reducing agents, (3) printing with discharge colours comprising hydrosulphites as reducing agent and a salt or salts of citric or tartaric acid for producing a white discharge, and in addition a vat, sulphur, or other dye for a coloured discharge, and (4) after-treating the fabric by ageing, soaping, etc. —A.

Dyeing Apparatus (Hank type). Leek and Son, Ltd., Leek. E.P.177,211, 30/3/22.

The hanks are carried by porcelain, etc., or non-corrodible metal reels of cross shape in cross-section, so as to provide deep circumferential grooves into which the treatment liquor is carried. The reel-carrying spindles are provided with chain pulleys to admit of rotating at all positions of the carrier by means of an endless chain. —A.

Basic Dye: Application. Farbenfabr. F. Bayer and Co. G.P.347,131. Chem. Zentr., 1922, ii, 480.

A process is described for the fixation of basic dyes on cotton. The material is treated with a condensation product of an aldehyde with di- and poly-hydroxybenzenes or their carboxylic or sulphonic acid derivatives, with or without a mordant, and subsequently dyed with basic dyes. Compared with tannin, these water-soluble condensation products have the advantage that they are produced directly on the cotton. The colours are not sensitive to iron. —J. C. W.

Bacteria Diastase: Application. A. Boidin and J. Effront. G.P.349,655. Chem. Zentr., 1922, ii, 876.

A process is described for removing all kinds of starchy, gummy, fatty and gelatinous material, present in textile goods as the result of sizing, by means of bacteria. The goods are subjected to the action of bacteria diastases produced by *B. subtilis* and *B. mesentericus* cultures. Bacteria diastase solutions are superior to malt extracts in that they contain no fermentable carbohydrates and possess a greater stability, activity and resistibility to temperature changes. —J. C. W.

Imitation Wool; Production of——. J. Bourbon. F.P.528,465. Chem. Zentr., 1922, ii, 650.

An appearance similar to that of wool can be given to vegetable fibres by first bleaching the fibre with potassium permanganate and sodium bisulphite, then bringing it into a bath containing zinc chloride and caustic soda, and rinsing and drying it. The treated fibre is curly, lustrous and elastic, and can be more easily dyed than the untreated material. —J. C. W.

Cotton Hair; Strengthening——. J. Korselt. G.P.348,194 and 349,179. Chem. Zentr., 1922, ii, 759-760 and 876.

A process is described for increasing the strength and elasticity of wool, cotton and other vegetable fibres, before or after spinning, as well as of dyed or non-dyed artificial silk, hair and feathers. The material is treated with ferments or mixtures of ferments which do not degrade starch or albumen and do not bring about alcoholic fermentation. Co-ferments may be added to increase the catalytic action of the enzyme. A solution or emulsion of catalase, reductase, perhydrase, inulinase, etc., may be employed, together with creatinine, caffeine, or cinchonine as activators. It is also claimed that the alkaloids and purine bases and their salts will themselves increase the strength of elasticity of wool, hair, or feathers.
—J. C. W.

Cotton "Effect" Thread; Preparation of—. Cassella and Co. G.P.347,130. Chem. Zentr., 1922, ii, 486.

Cotton is soaked in a 25% solution of zinc chloride, pressed out, and dried, the temperature being not too high. It is then transferred to a closed air-tight vessel, where it is treated with acetic anhydride vapour under reduced pressure at 40-45° for a period of 50 hours. The increase in weight of the fibre should not be greater than 40-45%, and the process is stopped just short of the production of soluble cellulose acetates. The "effect" threads so obtained are white, flexible and strong. They are not coloured by direct dyeing.
—J. C. W.

Recovering Fats and Soaps from Wash Liquors. (Cuprammonium Cellulose.) J. Duclaux. E.P.172,012, conv. 23/11/20; F.P.527,543.

The membrane of an ultra-filter through which wash waters are filtered under pressure in a process for the recovery of fats and soaps can be formed from cellulose precipitated from cuprammonium cellulose solution. —J. C. W.

Dyeing: Apparatus and Method. Ludwig H. Biach, New Haven, Conn. U.S.P. 1,415,513, 9/5/22. Appl. 13/7/20.

The method consists of dyeing by first heating and superdrying substantially dry material and then subjecting the material to the action of the dyeing fluid. —A.

5.—LAUNDERING AND DRY-CLEANING.

Soap Solution: Detergent Power. See Section 6.

6.—ANALYSIS, TESTING, GRADING, AND DEFECTS.

Machine Gauges. C. Marschik. Textilberichte, 1922, 3, 110, 160.

A number of sensitive gauges, useful in the construction and erection of textile machinery, are described. —J. C. W.

Guncottons; (Determination of Coefficient of) Gelatinisation of——. J. Desmaroux. Jl. Soc. Chem. Ind. (from Mém. Poudres, 1921, **18**, 169-182), 1922, **41**, 388A.

An account is given of attempts to measure the variations shown by different samples of guncotton in their ability to form pastes. The best results were obtained by measuring the solubility of the guncotton in mixtures of amyl alcohol and ether. The presence of water and the temperature have a very marked influence. The addition of 1% of water increased the solubility of one sample from 16% to 100%, and a decrease of temperature from 20°C. to 12°C. increased the solubility of another sample from 16·5% to 82·5%. Details are given of the method of determination of the coefficient of gelatinisation of guncottons. Curves are given showing how the yield of paste and consumption of solvent varied with the coefficient of gelatinisation of the guncotton used.
—J. C. W.

Cell Wall: Permeability. L. Lapicque. Physiol. Abstr. (from Compt. rend. soc. biol., 1921, **84**, 493-496), 1922, **7**, 72.

Cladophora glomerata and *C. oligoclona* become plasmolysed when transferred to acidulated water, whilst the cellulose membrane swells and loses its sharp limits. These changes take only a few seconds, are independent of the osmotic pressure, and can be observed with ·001 N. HCl. Alkalis have no influence on the normal cell, but on cells treated with acid they act in the contrary sense to the acid. From these observations the author supposes that the reaction of the external medium is more important for the intake of water than the osmotic pressure. The two colloids, protoplasm and cellulose, appear to carry different charges, as one is coagulated by acids and the other by alkalis. —J. C. W.

Plant Cell: Hydrogen Ion Concentration. W. R. G. Atkins. Sci. Proc. Roy. Dublin Soc., 1922, **16**, 414-426.

Plant cells are rarely alkaline, and pH 8 is not surpassed in them. On the acid side pH 1·4 has been observed. By a microchemical method it is possible to determine the pH values of the cells and tissues. The xylem is more acid than the pith and medullary rays, and the midrib of a leaf more acid than the parenchyma. Parenchymatous tissue is often in the neighbourhood of pH 6; woody tissue near pH 5 or more acid. When grown in neutral or alkaline soil the root is usually less acid than the other portions of the plant. The pH value in a tissue is usually near, but slightly less than, the optimum for the activity of the characteristic enzyme at ordinary air temperature. This ensures that the acidity does not destroy the enzyme at such higher temperatures as may be experienced by the plant under natural conditions. Attention is drawn to the usefulness of di-ethyl red as a reagent for microchemical work. —J. C. W.

Stalagmometer: Application. R. de Izaguirre. Jl. Chem. Soc. (from Anal. Fis. Quim., 1922, **20**, 40-55), 1922, **122**, ii, 262.

The surface tension of aqueous solutions of night-blue of varying concentrations and with the addition of different electrolytes was investigated by means of the stalagmometer. The increase of surface tension with concentration is fairly rapid at first, then slows down. In experiments with the addition of electrolytes it was found that an abrupt fall in surface tension to that of pure water took place at the point where coagulation of the solution occurred. The coagulating power of various ions can thus be studied by means of the stalagmometer. Other physical properties, including the aspect under the ultramicroscope, do not show this abrupt change at the point of coagulation. Solutions purified by dialysis give results analogous to those obtained with unpurified material, but the stability of the solutions obtained is less, since smaller concentrations of salts are necessary for coagulations. —J. C. W.

Humus; Function of——. H. J. Page. Trans. Faraday Soc., 1922, **17**, 272-287.

An outline of the general physico-chemical aspects of the relation of the organic matter of the soil to soil fertility. The general effect of humus on a mineral soil may be summed up as that of a "buffer" substance, using the word in its widest sense. Its effects on the tilth, on soil moisture, soil temperature, and soil solution are all such as to avoid harmful extremes, and to bring the properties of the most divergently composed mineral soils nearer to a mean, which tends to give the most stable and uniform cropping results under very variable climatic and weather conditions. —J. C. W.

Torsion of Fibres. J. Beckering Vinckers. Mededeel. Rijksvoorlichtingsdienst, Delft, Holland, 1922, No.3, 21.

The amount of torsion which the different textile fibres can stand has been determined. In reality, a thread is formed by twisting many fibres together, but to obtain more comparable results the torsion has been fixed for a single fibre. Thin fibres may be twisted more often before breaking than thick ones of the same material. The relation between the two has been determined, and it has been found by calculation that the number of possible torsions shows a consistency in proportion to the square root of the counts. This proves to be the same formula as the one used for calculating the twist in yarns. Mathematical deductions are given. The figures found for the different fibres examined are:—Cotton 350, reeled silk 248, sisal hemp H.V.A. 221, Manila J. grade 218, Lincoln wool 214, Dutch hemp 141, blue flax 130, artificial silk 125, jute 64. —S. a. v. H.

Micro-Cataphoresis Apparatus. S. E. Mattson. Kolloidchem. Beihefte, 1922, **14**, 309-312.

A detailed description is given of a new apparatus for measuring the speed of migration of ions. —J. C. W.

Viscostalagmometer. I. Traube. Biochem. Zeitsch., 1921, **120**, 106-107.

A new viscostalagmometer, which comprises a simple apparatus for measuring the surface tension and friction of liquids of very different viscosities, is described. Each instrument is fitted, by means of a ground glass joint, with several capillary tubes of different internal diameter. These tubes are interchangeable according to the nature of the liquid to be tested.—J. C. W.

Cotton Testing; New Methods in——. W. Frenzel. Mededeel. Rijksvoorlichtingsdienst, Delft, Holland, 1922, No.2, 18.

Some methods of testing cotton and cotton yarns—methods less generally known—are mentioned. In order to estimate the fineness of the fibres in a sample of yarn, the metric counts of both yarn and fibres are determined by weighing one metre of the yarn and multiplying by the number of fibres per cross section. To count the fibres, the yarn is cut up into pieces of 1½—2 mm. and these laid out with a pincet. In this way an extensive examination was carried out in a cotton mill showing the fineness of fibre for self-actor yarn 16's—114's of 4,100—5,500, ring yarn 23's—78's of 3,540—5,000. The metric counts of the yarn are reversely proportionate to the number of fibres per cross section, which is the same for any yarn spun from one species of cotton. This relation is reproduced in diagram form for various counts, and the number of fibres for any fineness of yarn may be read from the graph. If, for instance, the combing machine works on a fleece of 122,550 fibres per distance where 5,000 needles form the comb, it follows by calculation that not each fibre but every 2–3 will pass at a time. —S. a. v. H.

Amylase; Activity of——. J. Effront. Chem. Zentr. (from C. r. soc. de biologie, 1922, **86**, 269-271), 1922, ii, 609-610.

A method for estimating the liquefying power of amylase, based on the coagulating action of iodine on starch paste, is described. Two ccs. of a 1% paste made from potato starch is warmed with 2 ccs. of a solution of the active substance in different dilutions to 40 or 60° according to the optimum temperature of the diastase concerned. At intervals of 2 to 5 mins., 2 drops of the mixture are transferred to a porcelain plate and mixed with 1 drop of a 0·1N iodine solution. The action of the diastase is recognised by the breaking down and final disappearance of the blue flaky precipitate present in the control test. —J. C. W.

Cell Wall; Structure of——. W. Stiles. New Phytologist, 1922, **21**, 49-57.

A further instalment of a general account of permeability in the living cell, the structure of the cell wall being considered. —J. C. W.

Cell Wall; Permeability. C. A. Shull. Trans. Faraday Soc., 1922, **17**, 255-259.

Several problems connected with the osmotic phenomena of plant life are considered, including the nature of osmotic pressure, the cause of semipermeability in membranes, and the cause of unilateral movement of water across the semipermeable septum. —J. C. W.

Frequency Equation; Modification of——. G. A. Linhart. Bot. Abstr. (from Proc. Nation. Acad. Sci., 1920, **6**, 682-684), 1921, **9**, 39.

A simplified method for the statistical interpretation of experimental data is described. —J. C. W.

Water Purification. A. M. Buswell and G. P. Edwards. Chem. & Met. Eng., 1922, **26**, 826-829.

The chemistry of the alum-coagulation process is represented by a diagram which emphasises both the interdependence of the various equilibria involved and the importance of the hydrogen ion. Data on the alkalinity changes during treatment do not accord with expected changes as ordinarily calculated. Various reasons for these discrepancies are discussed. The data presented show that there is usually less dissolved alumina in the effluent than in the untreated water, and generally does not exceed 2 mg. per litre. Points plotted with " residual alum " and pH values as co-ordinates indicate a minimum alumina content at a p.H. of 6, which was the lowest value reached in this series. —J. C. W.

Light; Physiological Action of——. J. H. Clark. Physiol. Reviews, 1922, **2**, 277-309.

In a general survey of the physiological action of light, the author considers its therapeutic action and reviews the photoelectric theories of light action.—J. C. W.

Perkins Tester. Text. World, 1922, **61**, 2329.

The Perkins tensile tester is illustrated. By turning a handwheel the piece of cloth under test is subjected to a direct pull which operates on a fluid in a cylinder. Simultaneously a standard pressure gauge is acted upon by the fluid. At the instant the cloth breaks, the pointer on the gauge automatically stops and remains stationary until released, indicating the exact tensile strength of the cloth in pounds per inch strip to the exact point of rupture. —J. C. W.

Dye: Fastness. W. Ostwald. Chem. Zentr. (from Z. ges. Textilind., 1922, **25**, 94-95), 1922, ii, 875.

The author discusses the factors which influence the action of light on dyestuffs. For the photochemical action of light there is a limiting intensity below which no reaction takes place. The author states that the greatest attenton must be given to the dependence of this limit on the wave length if a fundamental decision concerning fastness to light is to be reached. If the limit is over-stepped, a measurable chemical action results, but if the time during which this takes place is only short the dyestuff entirely recovers its original condition if placed in the dark. Dyes can therefore be exposed to the action of light for a considerable length of time, without change, if at short intervals they are allowed to remain in the dark for recovery. These conditions are fulfilled by the alternation of day and night. —J. C. W.

Cellulose Acetate: Solubility. K. Schweiger. Chem. Zentr. (from Z. physiol. Chem., 1921, **117**, 61-66), 1922, i, 324.

Cellulose acetate is soluble in solutions of salts of the alkalis and of the alkaline earths. Various commercial cellulose acetates were employed, and the solubility ratios determined at 15° and 100°. Solutions containing as much as 20—30% of cellulose acetate could be obtained. The internal friction of the solution changes on storing and is higher in solutions prepared at higher temperatures. The solvent power of the salts depends upon the ions present, and these can be arranged in the order which applies for the hydration of the ions. By treating the acetate with zinc chloride, acetic acid is evolved. Octa-acetylcellobiose and penta-acetylglucose dissolve easily in solutions of calcium thiocyanate, calcium bromide, calcium chloride, etc., without saponification taking place. Nitrocellulose dissolves in calcium thiocyanate and swells in calcium chloride without appreciable decomposition. —J. C. W.

Cottons; The Copper Number of——. Koehler and Marqueyrol. Jl. Soc. Chem. Ind. (from Mém. Poudres, 1921, **18**, 73-80), 1922, **41**, 323A.

A solution of copper sulphate is mixed with a solution containing crystallised sodium carbonate and sodium bicarbonate. The mixture is heated to boiling, poured on the cotton, and the whole heated in a steam bath. The cotton and cuprous oxides are separated by filtration, and the latter is dissolved by treatment with a solution of ferric sulphate and sulphuric acid. The cotton is filtered off and washed and the ferrous sulphate formed is titrated with a solution of potassium permanganate. Practical details of the method, which gives very concordant results, are given. A table of the copper numbers of cottons from various sources is given. —J. C. W.

Jumbo Mullen Tester. Text. Mfr., 1922, **48**, 87.

The Jumbo Mullen strength tester registers automatically the strength of fabric in pounds per sq. inch, under bursting strain. The fabric is clamped over one end of a cylinder containing a liquid which is forced up against the cloth by turning a hand wheel. A rubber diaphragm prevents the cloth from being wetted by the liquid. Simultaneously, the liquid acts on a standard pressure gauge so that the pressure, which is increased until the fabric is burst, is registered in pounds per sq. inch. At the breaking point, the gauge pointer remains stationary. —J. C. W.

Gelatin and Glue; The Evaluation of——. R. H. Bogue. Jl. Ind. Eng. Chem., 1922, **14**, 435.

A discussion of the methods employed in the evaluation of gelatin and glue indicates the failure of the present methods to give correct results, from lack of standard procedures for measuring properties, and from absence of a scientific method of expressing the data which are obtained. An attempt to bring about standardisation in gelatin and glue testing is described. The gelatin content of glue or gelatin, and also the joint strength of a glue, may be correctly indicated by a melting point determination, but neither may be assumed to be, in all cases, proportional to jelly consistency or to viscosity at 60°C. The measurement of the viscosity of an 18% solution (dry basis) at 35°C. by means of the MacMichael viscosimeter has been shown to be especially well adapted as an indirect estimation of the differentiation of glues and gelatins in the order of their melting points, and is recommended as the basis for the primary evaluation of these products. A system designating the grade of a product based on the results of this viscosity is outlined. Tests of jelly consistency and viscosity at 60°C. are of use in secondary evaluation. —J. C. W.

Cellulose: Hydrolysis. Chem. Zentr., 1922, ii, 827 (from F.P.22,344/1917; cf. 514,987).

A process for the preparation of hydrolytic products of cellulose and of its derivatives is described. Cellulose hydro or oxycellulose is introduced into a mixture of sulphuric acid and hydrochloric acid containing less than 38% of hydrochloric acid. The mixture is agitated constantly and meanwhile cooled with water. After a short time, a clear viscous solution is formed. If the solution is allowed to stand longer, a gradual breaking down of the polyoses to dextrose takes place. The solution of the cellulose in the acid mixture is hastened and made more complete if it is previously treated with alkali. —J. C. W.

Hydrogen Electrode Vessel. E. A. Keeler. Jl. Ind. Eng. Chem., 1922, **14**, 395-398.

A general account is given of the application of ion concentration measurements, particularly H-ion concentration measurements, to the control of industrial processes. Several new electrodes, well suited for industrial work, are described. —J. C. W.

Acetylation of Cellulose. L'Ind. Text., 1922, **38**, 181.

The acetylation of cellulose, hydrocellulose, oxycellulose, and cellulose hydrate is considerably accelerated by the addition of small quantities of hydrazine sulphate or hydroxylamine sulphate. About 1—2% of either of these salts may be added to the mixture of acetic acid and acetic anhydride or the cellulose may be impregnated with solutions of the salts, dried, and transferred to the acetylation mixture. Esterification is complete in 1 to 6 hours according to the temperature and the quantity of catalyst added. —J. C. W.

Amylase; Activity of——. H. Luers and W. Wasmund. Chem. Zentr. (from Fermentforschung, 1922, **5**, 169-235), 1922, ii, 699.

A physical-chemical study of the starch-amylase system and the method of action of the ferment is described. The effect on the speed of reaction of (1) concentration of the substrate, (2) concentration of the ferment, (3) dilution at the same relative concentration of the substrate, (4) temperature, (5) the presence of the products of the reaction, and (6) the physical and chemical nature of the substrate are discussed. The influence of change of optimum hydrogen ion concentration and the characterisation of the amylase preparations are considered. —J. C. W.

Glucose; Estimation of——. I. Greiner. Biochem. Zeitsch., 1922, **128**, 274-278.

It is shown that theoretically the Bertrand process should be applicable to the estimation of any quantity of sugar, but practically it can only be employed for quantities greater than 10 mg. in 20 ccs. of solution. A modified process is described in which, in addition to the copper sulphate solution, a solution containing only Rochelle salt and caustic soda and a second solution containing sodium carbonate and sodium bicarbonate are employed. This modified method is of general application. —J. C. W.

Di-Ethyl Red: Application. W. R. G. Atkins. Sci. Proc. Roy. Dublin Soc., 1922, **16**, 414-426.

This indicator changes from yellow at p.H 6·0 to red at 5·8, that is, it gives a red with many plant tissues. It is also readily absorbed by such tissues, and may therefore be recommended as a microchemical reagent. —J. C. W.

Starch: Fermentation. H. V. Euler and O. Svanberg. Biochem. Zeitsch., 1922, **128**, 323-325.

The optimum acidity for the growth of *B. macerans* is about p.H 6·8. Starch, under the experimental conditions described, is almost quantitatively converted into amyloses by its action. Thus at the end of the reaction there is no colouration with iodine, the total carbohydrate content remains unchanged, and the loss of weight and formation of substances which reduce Fehling's solution is very low in proportion to the quantity of starch employed. The activity of *B. macerans* is influenced by the temperature and composition of the nutrient solution.

—J. C. W.

Soap Solution: Viscosity. A. M. King. Jl. Soc. Chem. Ind., 1922, **41**, 147-148T.

Experiments are described which show that whereas the addition of salt causes clear liquid soap solutions to set to a transparent jelly, further addition reliquefies the jelly without impairing the homogeneity of the solution. A much greater amount of salt is required to cause formation of two liquid layers and finally formation of curd. Almost all the solutions on standing had a narrow white rim at the top.

—J. C. W.

Constant Humidity Case. C. F. Hottes. Rev. App. Mycology (from Phytopath., 1921, **11**, 51), 1922, **1**, 117-118.

An apparatus to maintain a constant humidity within a variation of ± 1% in the study of plant growth is described. The case is constructed of wood, with the top and sides of three thicknesses of glass to give two dead air spaces for insulation. It may be so arranged that the roots of experimental plants may be placed under conditions like or unlike those of the shoots through independent regulation of the temperature and humidity of the lower base of the apparatus, which is separated from the plant chamber by a perforated "transite" plate through which the shoots pass. The humidity is controlled by a Johnson Service Co. humidostat, which actuates through an electro-magnetic valve the flow of compressed air through the humidifying or drying apparatus.

—J. C. W.

Soap Solution: Detergent Power. R. T. A. Mees. Jl. Chem. Soc. (from Chem. Weekblad, 1922, **19**, 82-85), 1922, **122**, ii, 268.

It is shown that the conception of Martin Fischer of a soap solution as a two-phase system and the orientation theory of Langmuir and Harkins are inadequate. The detergent power of soaps is primarily a chemical property due to the polarity of molecules insoluble as such in oil and water.

—J. C. W.

Staple Length, Average Fibre Length, and Staple Diagrams of Cotton Fibres. W. Frenzel. Mededeel. Rijksvezeldienst, Delft, Holland, 1921, No.7, 21-58.

Dr. Frenzel suggests a method for constructing diagrams of the lengths of fibres in a piece of yarn or a sample of cotton. The diagrams will vary through the different cleaning and spinning processes from the raw cotton to the finished product. Availing himself of some principles laid down by Prof. Müller (Dresden) and Prof. Johannsen (Reutlingen), Dr. Frenzel has worked out a very simple and accurate method of calculating the frequency of the lengths of fibres in an average sample of yarn or cotton. The fibres are prepared by arranging them into a fringe, issuing from a mutual basis. By cutting up this fringe or beard into parts, and weighing the particles on a torsion scale, the diagrams may be constructed by means of some given formulæ, *i.e.*, relation between the lengths of fibre, number of fibres, weight and fineness of the yarn. In a series of results published in this article and in others to follow, the practical application of the method is demonstrated. Dr. Frenzel contemplates applying his methods to other fibrous materials (wool, etc.).

—S. a. v. H.

Wool Yields; Estimating——. Wool Rec., 1922, **21**, 1,324-1,329.

An account of the estimated and actual yields, after scouring, of wool dealt with by the French Government during the war. The wool came under four heads:—Greasy wool; wool washed before shearing, and pulled wools treated by the Mazamet process; partially scoured wools; fully scoured wools. The following conclusions were reached:—In the case of greasy wools, laboratory tests gave yields greater than actual yields; scouring a number of bales on a commercial scale gave yields within ½% of final result; with washed and scoured wools the tests of small samples drawn carefully from bulk gave results close to actual yield.

—F. P.

Fastness of Dyed Wool and Silk to Fulling, Scouring and Washing; Provisional Method on——. Amer. Dyestuff Reporter, 1922, **10**, 332, 374.

Details are given of fulling and washing tests and classification of colours. These provisional methods have been drawn up by the Research Committee of the American Association of Textile Chemists and Colorists, and criticisms or suggestions that may be necessary for the improvement of the methods are invited.

—L. M. S.

Yarn Testing. Linen and Jute Trades Jl., 1922, **10**, 1,303.

A proof reel for measuring and averaging linen yarns for weighing to ascertain their count is described.

—L. M. S.

Dyed Silks; Cause of Nibs and Lousiness in——. L. C. Lewis. Amer. Dyestuff Reporter, 1922, **10**, 327.

The seed producer should consider the structure of the fibre and eliminate those breeds in which the silks are usually channeled or subject to exfoliation. Dyers should treat the silks in such a way that nibs or exfoliation shall not appear. —L. M. S.

Shady and Cloudy Goods; Causes of——. L. F. Bume, T. J. Biery, L. N. Putnam. Amer. Dyestuff Reporter, 1922, **10**, 337-344.

A series of papers were read on this subject at a meeting of the American Association of Textile Chemists and discussion followed. —L. M. S.

The Detection and Estimation of Acidity and Alkalinity in Cotton Fabrics. See This *Jl.* (Trans.), 1922, **13**, 121.

7.—BUILDING AND POWER.

(A)—CONSTRUCTION OF BUILDINGS.

Ferro-Concrete Building: Vibration. B. Haas. Chem. Zeit., 1922, **46**, 289-290.

The effects of vibration in ceilings, floors, and walls, constructed of ferro-concrete, in industrial buildings are discussed. The phenomenon is a consequence of the monolithic structure of ferro-concrete. In bleacheries, such vibration occurs to a considerable extent as a result of the revolution of the propellors of the hollanders. Methods are proposed by which the resulting waste of power can be cut down. —J. C. W.

(B)—FIRE PREVENTION

Heat-closing Firedoor; The Automatic—. J. A. Collins. Text. World, 1922, **61**, 187.

Describes the construction of fireproof doors and of devices for automatically closing them in the event of fire, the essential feature of the devices being a fusible link which projects into the opening when the door is open and which, on melting, releases a counterweight and causes the door to close either by its own weight or by the action of external weights. —V. M.

(C)—POWER.

Leather Belting; Grain or Flesh Side for——. Canad. Machinery, 1922, **27**, 45.

Gives results of tests made by the Leather Belting Exchange at Cornell University on five 4in. single belts 30ft. long of different manufacture. The method of testing was to measure horse-power and slip first when running on the grain side and then on the flesh side at the same belt speed and with the same initial belt tension. A summary of all the results is definitely in favour of the grain side; in fact, with average shop tensions the flesh side will only do 50 to 60% as much load as the grain side. —V. M.

Steam Production. See This *Jl.* (Proc.), 1922, **13**, 109.

(D)—LUBRICATION.

Lubricant; The Choice of——for Knitting Machines. J. Worm. Textilberichte, 1922, **3**, 108.

The author emphasises the necessity for a careful choice of lubricant, and instances a case where a change of oil increased production by forty pairs of stockings a week. The effect of a number of oils on various metals and their alloys is described. —W. E. B.

(F)—LIGHTING.

Lighting Code; Tentative——. Text. World, 1922, **61**, 79.

Gives recommendations made by the Massachusetts Department of Labour and Industries for lighting industrial establishments. The minimum intensity of light in foot candles required at the work is:—For roadways, ·02; storage spaces, ·25; stairways and passages, ·50; rough manufacturing operations, 1 to 2; fine manufacturing operations, 3; special cases of fine work, 5 to 7. Other rules deal with shading and distribution of light, pilot lights, etc. The maximum surface brilliancy of shades is fixed at 15 candle power per sq. in. —V. M.

Cotton Mill Lighting. J. M. Ketch. Cotton, U.S.A., 1922, **86**, 401-404.

The best conditions of illumination for the special requirements of the different rooms are described. —J. C. W.

(H)—HUMIDIFICATION.

Air Conditioning; Hints on— T. Francis. Canadian Text. Jl., 1922, **39**, 86

The use of the psychrometric controller, with wet bulb cooled with wick and water reservoir, is recommended. A chart is given showing the relation between temperature, relative humidity, and "regain." The moisture in cotton as taken from the bale varies, but averages 10½% regain, which is too much for good cleaning. Humidifying is therefore inadvisable in the blowing room. For subsequent processes, the humidities should be approximately:—Carding, 6% R; roving, 6—7½% R; spinning, 7—8% R; warping, 8½—9½% R; weaving, 10—11% R; cloth room, 8½% R; but experience under any particular conditions may indicate advantage in some deviation from these values. —V. M.

PATENTS.

Ventilating and Humidifying Spinning Rooms, etc. Hall and Kay, Ashton-under-Lyne. E.P.177,815, 30/3/22.

To ventilate and regulate the humidity of wet spinning and like rooms, conditioned air is admitted in regulated quantities in the immediate neighbourhood of the creels from louvered chambers arranged just above and connected with a conditioned-air main. —A.

8.—DESIGN.

Tapestry Designs. W. H. Döring. Text. Kunst u. Industrie, 1922, **13**, 19.

The new designs of Prof. Em. J. Margold for tapestries, printed linen, and linen tablecloths are described and illustrated. —L. M. S.

Harmony and Defects of Colour Combinations. See Section 3D.

9.—COMMERCE, ECONOMICS, LABOUR, ORGANISATION, COSTING, &c.

German Textile Industries: Comparison with Pre-War Output. Times Trade Supp., 1922, **10**, 186.

Details are given of the production of raw materials and manufactured goods, employment, and trade balance.—L. M. S.

Austria; Market for British Textiles in—. Bd. of Trade Jl., 1922, **108**, 667.

British goods are now competing with certain classes of Czech and German textiles on the Viennese market, such textiles as linings, including Italians and Venetians, having been in demand. Suggestions are made for British exporters. —L. M. S.

Italian Artificial Silk. Chem. Trade Jl., 1922, **70**, 702.

There are five mills in Italy manufacturing artificial silk. One of these factories situated in Venetia produces about 25% of the output, and is erecting two new mills. All mills use the viscose process. The Italian industry now exports considerable amounts, in addition to meeting the domestic demand. In 1921 exports amounted to 588,834 kilos. —L. M. S.

Switzerland: Silk Industry in 1921. Bd. of Trade Jl., 1922, **108**, 585.

The value of the manufactured silk goods sent to England in 1921 was 69 million frs. The year has been a time of trouble, the high value of the franc being against export; business had improved by the end of the year. The annual production amounted to 45 million metres of stuffs and 22,000 people were employed; 2,000,000 kg. of raw silk were used. —F. G. P.

The Future of the Cotton Trade. See This *Jl.* (Proc.), 1922, **13**, 112.

The Proper Functions of Trade Unions. See This *Jl.* (Proc.), 1922, **13**, 119.

Exchange Stabilisation. See This *Jl.* (Proc.), 1922, **13**, 118.

10.—MISCELLANEOUS.

Standardization of Colours. H. Trillich. Color Trade Jl. (from Farbenzeitung), 1922, **10**, 194.

The arguments in favour of Ostwald's colour system are reviewed and a colour grading scheme is proposed and explained. —L. M. S.

Mill Machinery; Proper care of—when Idle. H. D. Martin. Text. Colorist, 1922, **44**, 379.

A general account of precautions to be taken when a mill must be shut down. Paper is the best material with which to cover machinery, since dust cannot penetrate it. Cloth does not offer much protection, but, if it is used, bleached cloth is best. Less dust will pass through ordinary grey goods because bleached cloth has a flatter surface and the face is fuller or better filled. —J. C. W.

Formaldehyde Lamp. E. Berger. Compt. rend., 1922, **174**, 1471-1474.

A new form of lamp is described in which the catalyst is contained in a basket of copper gauze which rests directly on the wick. The catalyst, or the catalyst together with its basket, is heated, and heats the wick by contact, causing greater quantities of alcohol to evaporate. The chimney in which the formation of formaldehyde takes place is insulated from loss of heat. This lamp has been proved efficient for disinfection purposes. —J. C. W.

Double Window. H. Hausen. Z. Techn. Phys., 1922, **3**, 173-179.

Double windows occasion a loss of heat from 3 to 10 times as much as the same area of wall, and should, therefore, be designed to admit the maximum of light for the smallest surface. The subject is treated geometrically and mathematically, and two types of double window are compared, namely, a common form, in which the glass surfaces were about 5″ apart, and the "Lang" window, which has the two panes fixed in one frame, about 1½″ apart. It is shown that the latter type admits 20% more light than the former. —J. C. W.

ABSTRACTS

I.—FIBRES AND THEIR PRODUCTION.

(B)—ANIMAL.

Japan; An Outline of Sericultural Industry, etc. in——. Experiment Sta. Rec. (from Tokyo: Dept. Agric. and Comm., 1921), 1922, **46**, 246

Discusses the present state of sericulture in Japan. —W. R.

Raw Silk; Lousiness in——. M. D. C. Crawford. Women's Wear, 1922, **24**, 6.

Micro-photographs show the presence of this defect upon raw silk fibres. In the opinion of Mr. McDowell the fault is caused through sickness of the silk worms which reacts upon the silk as it emerges from the spinnerets. He suggests, however, that part of the trouble is caused by the dyers not straining the boiled-off liquor used in the baths. Similar troubles have been noted in wool from sheep fed on poor pastures and also in immature cotton. Experiments with silk-worms are suggested, with a view of locating and curing the trouble. —F. G. P.

Studies on the Mendelian Inheritance of the Important Racial Characteristics of Karakul Sheep in Pure Breeding and in Crossing with Rambouillets. L. Adametz. Experiment Sta. Rec., 1922, **46**, 270.

This volume (German) consists of eight papers on sheep breeding. Those of most interest from the point of view of the textile industry deal with the inheritance of Karakul curl in crosses and with the inheritance of hair colour within the Karakul breed and also in crosses of this with Rambouillets. —W. R.

A Micrological Study of the Fleece of the Black-face Lamb. See This *Jl.* (Trans.), 1922, **13**, 149.

Paraguayan Exports of Wool Declining. See Section 9.

German Fibre Substitutes. See Section 1D.

(C)—VEGETABLE.

Cotton Leaf; Movements of——. R. M. Meade. Jl. Heredity, 1922, **12**, 444-448.

The leaves of the cotton plant are constantly adjusting their positions according to the directness of the sun's rays and to varying conditions of soil moisture. The movements of the leaves in response to light are controlled by the basal pulvinus and the distal pulvinus located on the petiole of the leaf. The distal pulvinus raises or lowers individual lobes of the leaf-blade, and the basal pulvinus changes the position of the whole leaf.—J. C. W.

Isolated Root Tip: Growth. W. J. Robbins. Bot Gazette, 1922, **73**, 376-389.

The growth of isolated root tips of such plants as peas, corn and cotton has been studied. These are found to grow well in the dark in sterile culture solutions containing mineral salts and carbohydrates, but not in the absence of carbohydrates. Glucose gives much better growth than fructose. The root tips of corn exhibit geotropism. —J. C. W.

Plant Anthracnose. T. Hemmi. Experiment Sta. Rec. (from Ann. Phytopath. Soc., Japan, 1920, **1**, 13-21), 1922, **46**, 239.

One of the diseases described is a stem and cotyledon disease of flax seedlings caused by *Colletotrichum linicolum.* —W. R.

Chlorine; Technical Use of——in Isolating Plant Fibres. P. Waentig. Papier-Fabrikant Festheft, 1922, **20**, No.23A, 67-71.

A critical review of the technical use of chlorine in the decomposition of vegetable fibrous material. Among the comparatively recent patents discussed are those of Green, Cataldi, and Franz.—J. C. W.

Pure Seed in Relation to Community Production of Cotton. G. S. Meloy. Expt. Sta. Rec. (from U.S. Dept. Agric. Bur. Markets Pamphlet, 1920), 1922, **46**, 229.

The value of pure seed and early and superior varieties in cotton production is indicated, and the manner in which seed is mixed in the field and at public gins described. "Running out" of seed generally occurs when the superior strain is crossed with inferior varieties in the field or mixed at the gin. An inferior variety may run out in like manner among cottons of superior character, but not without leaving its stain on the cottons of the community. True running out or degeneracy may be counteracted by careful roguing. The advantages of pure seed and of community production of single varieties are set forth in detail.—J. C. W.

Cotton Aphis; Checking——. R. Cottam. Reprint from the Entomologists' Monthly Mag., 3rd ser., 1922, **8**, 61-64.

The occurrence of an aphidophagus fly of the genus Leucopis is recorded, and the following observations on its life history and habits noted:—Its life-cycle is completed in 13 days; breeding is continuous while aphides are present on the plant; it occurs in sufficient numbers and is so voracious in its feeding habits as to constitute a valuable check to the increase of the aphides infesting dura and cotton; it is parasitised by a minute hymenopteron. —J. C. W.

Cotton Linters: Application. S. E. Seaman. Paper, 1922, **30**, 88-92.

The production of the raw material and the methods of preparation of cotton linters pulp, for use in the manufacture of paper, are described. —J. C. W.

Meade Cotton; Cultivation of——. Text. Rec., 1922, **40**, 43.

Meade cotton, a new variety which combines the superior cultural features of the Upland type with a long and silky fibre like that of Sea Island, has been shown to be a desirable substitute for Sea Island. It is not a hybrid, but is the result of the discovery and continued selection of a superior type. Meade cotton matures early, producing, under favourable conditions, a fibre 1$\frac{1}{16}$ in. long. On account of its early smooth seeds, it can be handled on the regular Sea Island gins. It was developed in North-eastern Texas, and profitable crops have been produced in the presence of the boll-weevil. Experiments on the Sea Islands of South Carolina have shown that at least twice as much Meade as Sea Island cotton, and not less than the short-staple varieties, can be produced under the same conditions. —J. C. W.

Studies on the Decomposition of some common Green-Manuring Plants at Different Stages of Growth in the Black Cotton Soil of the Central Provinces. D. V. Bal. Agric. Jl. India, 1922, **17**, Pt.2, 133-151.

Describes experiments on the decomposition of sann-hemp (*Crotalaria juncea*) and dhaincha (*Sesbania aculeata*) in black cotton soil. It is found that the earlier sann-hemp is used as a green manure the more rapidly is its decomposition effected. The slowness of decomposition of the full-grown green sann-hemp is possibly due to the largely reduced water content of the more mature tissues. —W. R.

Cotton Cultivation in Paraguay Expanding. U.S. Commerce Reports, 1922, May 15, 410.

The area devoted to cotton cultivation in Paraguay has doubled within the last three years. Official estimates place this year's crop at 1,000 metric tons of seed cotton. It is claimed that a 75% greater yield is obtained from seeds imported from the United States than from native seed. Yields of more than 1,800 lbs. of seed cotton per acre have been officially reported. Cotton picking in Paraguay begins in February. —L. M. S.

Cotton Growing in French West Africa. Bd. of Trade Jl., 1922, **108**, 703.

Trial stations have already been instituted on the Middle Niger. Cotton is cultivated by the natives throughout the valley, but is of poor quality on account of insufficient care and want of irrigation. On the other hand, the cotton produced by the stations is as fine as Egyptian cotton. The economic conditions of cotton growing in the colony on a large scale are to be investigated thoroughly. —L. M. S.

Belgian Congo: Production and Transport. Bd. of Trade Jl., 1922, **108**, 700.

The cultivation of cotton is at prese[illegible] an experimental stage, exports in [illegible]ons. having only amounted to 55½ tons, in 19[illegible] to 120 tons, and in 1920 to 600 tons. However, with the establishment of factories for the treatment of raw cotton it is anticipated that these figures will increase rapidly: many thousand hectares are now being planted. —L. M. S.

Cotton Boll-Weevil; Suggested Programme for Farming in S. Carolina under—— Conditions. Agric. Jl. India, 1922, **17**, Pt.2, 211-214.

The broad principles of operation against boll weevil for the whole State are outlined and special suggestions for different tracts are added. —W. R.

Hemp ("Cannabis sativa"); Differentiation of——from False (Sann or Bombay) Hemp ("Crotalaria juncea"). Chim. et Ind., 1922, **7**, 664-667.

Points out the differences between these two fibre plants, the one a member of the Urticaceae and the other of the Papilionaceae. The two types of fibre differ in length, colour, structure of associated epidermis, parenchyma and vessels, and also in the colour of the ash left on burning and in the percentage of oxide of iron in this ash. —W. R.

Cotton Culture in Brazil. W. W. Coelho de Souza. Experiment Sta. Rec. (from A Cultura do Algodoeiro no Brasil. Rio de Janeiro: Min. Agr., Indus. e Com., Serv. Inform., 1921, pp.110, figs. 15), 1922, **46**, 229.

Deals with the cultural operations and field practices involved in producing the cotton crop in Brazil, and gives notes on the history and extent of the industry, on marketing problems, insect pests and fungal diseases. —W. R.

Cotton in China: Report of Cotton Experiment Stations of the Chinese Mill-owners' Association. T. S. Kuo. Experiment Sta. Rec., 1922, **46**, 133.

Describes the work of the stations in acclimatising American Upland varieties, improving native varieties, demonstrating improved cultural methods and studying insect and disease control. Results of a number of variety tests are tabulated. —W. R.

[Flax]. The Growing Period of the Head-bearing Stalks of Wheat: Certain Relations between the Protein Content and Length. W. F. Gericke. Soil Sci., 1922, **13**, 135-138.

An account of experiments showing that the amount of tillering and the protein content in the grain are influenced by the application of nitrogen at different periods of the life history of the plant. It is possible that some similar relationship may hold for flax. —L. I. R. A.

Flax Growing in Kenya. Belfast News Letter, 1922, July 11, 4, and Bd. of Trade Jl., 1922, **109**, 3.

In 1918 between 8,000 and 9,000 acres of flax were cultivated in Kenya; in 1919 and 1920 from 20,000 to 25,000 acres were harvested each year; in 1921, 37,063 cwts. of scutched flax, 49,544 cwts. of tow, and 42,000 cwts. of linseed were produced. The production of tow to flax is admittedly high, but this will undoubtedly be remedied by a better understanding of the requirements of the flax industry, and as a consequence a better handling of the flax crop. The possibilities are that Kenya will yet become an important flax-producing centre, since it is anticipated that eventually they will be able to deliver flax in Great Britain at a lower cost than that from other countries. The difficulties of climate—especially as regards temperature and moisture in relation to retting—and of soil, as regards preparation and sowing, are gradually being better understood and overcome. Recently ten reasonably large samples of Kenya flax were examined, prepared and spun into moderately fine warp and weft yarns. The various flaxes were judged by several authorities to be far superior to pre-war Russian flax. They are equal to medium Irish, and if the water retting were better done they would compare favourably with most of the best Irish sorts. —F. B.

The Lesage Scutching Machine. L'Avenir Text., 1922, **4**, 288-291.

This machine is said to reduce the cost of scutching to one-seventh of the normal and to deliver a smaller percentage of tow. The method of operation resembles that of the hackling machine, successive handfuls of straw being placed in an automatic carrier and taken past combing drums, one set for the root end and another set for the top end of the straw. —L. I. R. A.

Flax; The Browning and Stem Break Disease of Cultivated—("Linum usitatissimum") Caused by "Polyspora lini." A. Lafferty. Sci. Proc. Roy. Dublin Soc., 1921, **16**, N.S.22, 248-274.

This paper gives a more scientific description of the disease than is contained in the paper on "Flax Diseases" by Pethybridge, Lafferty and Rhyneharl (This *Jl.*, 1921, **12**, 353). The external symptons are described and also the microscopical appearance of the fungus. It is stated that the hyphae have never been seen to penetrate the fibre bundles, but they cause an alteration in the chemical composition, the walls of the fibres becoming more lignified. If young seeds are attacked before the seed coat is developed they are totally destroyed because the embryo is affected, but in more fully developed seeds the fibrous layer of the seed-coat protects the embryo. The mode of origin of the conidiophores bearing the conidia is described, and measurements are given of the conidia. The author has not found any varieties of flax which are immune to the disease. —L. I. R. A.

Flax-pulling Machines; New——. W. Müller. Deuts. Faserstoffe, 1922, **4**, 49-51.

The following machines are briefly referred to:—Push-Tombyll, Marshall, Vessot, Freeman-Sumner, Zwionzek, Crawford and Bennett, W. H. Smith (Bath), Michot (Ireland). —L. I. R. A.

Flax Retting Effluents; Disposal and Purification of——. A. J. H. Gauge. Jl. Soc. Chem. Ind., 1922, **41**, 177T.

An account of investigations carried on at the Government Laboratory with regard to the question of the disposal of flax retting effluents to avoid pollution of rivers. It is concluded that flax ret waters can be partially purified by chemical precipitation with lime and aluminium sulphate. Biological treatment on sand or percolating filters of clinker, coke, etc., will purify them to an extent which will permit of their safe discharge into streams. Treatment on land or discharge into the sewers after neutralisation of the acidity are alternative methods of disposal. —L. I. R. A.

Seed-Cleaning Process; A New——. E. D. Eddy. Sci. Agr., 1921, **2**, 52-54.

The process in question is said to utilise centrifugal force to separate particles of different specific gravity completely and instantaneously. A liquid carrier with a specific gravity intermediate between those of the materials desired to separate is introduced together with the seed into a rapidly revolving bowl, and the seeds lighter than the liquid are forced to the centre, while those as heavy as or heavier are thrown to the circumference. Regulating the density of the liquid is said to bring under perfect control the proportions of the seeds going into the light and heavy separations. For cleaning clover seed, a liquid of a density of about 1·2 is usually required. Centrifugal action is again employed to remove the liquid from the cleaned seeds, which are then dried quickly in an air drier. Approximately 3 min. are required from the time the seed is first wet until all the loose moisture is thrown out by the extractor, and from 30 to 45 min. are needed to thoroughly dry the seed. —L. I. R. A.

Flax; Artificial Drying of——. H. Schurhoff. Deuts. Leinenindustrieller, 1921, No.45, 753-754.

The author recommends the following procedure in order to avoid any harmful results in drying flax artificially:—Wash after retting with fresh warm water from 15 to 20 min.; stand in 0·2% soda solution for 1 to 2 hrs., the temperature being higher than that of the retting water; wash well with warm water. —L. I. R. A.

Flax; Notes on the History of——. F. Zimmermann. Textilberichte, 1922, **3**, 198, 243.

Deals with the culture and uses of flax in ancient times. Biblical and other references are quoted. —L. I. R. A.

Flax Fibres and Accompanying Substances. A. Ganswindt. Textilberichte, 1922, **3**, 221.

A short historical account of the so-called "incrusting" substances of flax fibres and ways of removing them by the use of oxidising agents. Hugo Müller's method of estimating pure cellulose in bast fibres is described.

NOTE.—The author's assumption that lignin is the "incrusting" substance of flax fibres is quite contrary to current opinions. —L. I. R. A.

Cotton; Annual Report of British—— Growing Association. See This *Jl.* (Proc.), 1922, **13**, 132.

Cotton Research in India. See Section 6.

(D)—ARTIFICIAL.

German Fibre Substitutes. E. Neumann. Text. World, 1922, **61**, 2955-2956.

The present condition of the artificial silk, paper yarn, and artificial fibre industry in Germany is reviewed. "Vistra," a substitute for cotton, and "Lanofil," a substitute for wool, are produced commercially. "Staple fibre" is a failure, but rush fibre is used for carpets and rugs. The demand for paper yarns and fabrics is small. They are no longer used for clothing, but are satisfactory substitutes for jute. By feeding sheep with "Humagsolan," a preparation of cystine from horn, an improvement in German wool production is expected. —J. C. W.

PATENTS.

Viscose Silk Manufacture. E. Bronnert, Mulhouse, France. U.S.P.1,419,714, 13/6/22; Appl., 30/8/20.

Process for manufacture of very fine artificial silk, from 6 to 1 deniers, from raw viscose. The viscose is forced through suitable openings into a precipitating bath of sulphuric acid and ammonium sulphate, the concentration of the acid component of the bath being inversely proportional to the square root of the fineness of the thread desired measured in deniers and the amount of acid per unit volume of the bath, reckoning the ammonium sulphate as equivalent to half its weight of sulphuric acid is not allowed to fall below a certain minimum weight, the said minimum being experimentally determined for any one denier number. —A.

Artificial Threads; Viscose, etc. A. Kampf, Premnitz, Germany. E.P. 178,801; conv. April 21.

Threads, etc., and other articles prepared from viscose are obtained of increased strength by employment of raw or unripened viscose and a precipitating bath of mineral acid and salts—for example, a bath containing 7—13% of sulphuric acid and saturated with sodium sulphate.—A.

Artificial Filaments, etc. British Cellulose and Chemical Mfg. Co., Ltd., and Palmer and Dickie, London. E.P. 179,234, 4/5/22.

The strength of filaments and films prepared from cellulose-acetate solutions is increased by adding to the aqueous coagulating-baths solvents or latent solvents for the acetate which are soluble in or mixable with water, such as acetone, diacetone alcohol, alcohol, formic acid, acetic acid, zinc chloride. The use of the thiocyanates for this purpose (Specification 177,868) is excluded. By the employment of these baths, filaments as fine as 1—2 deniers may be drawn out from nozzles of relatively large diameter.—A.

Production of Textile Fibres and Cellulose from Flax, Sisal, Jute, etc., by using Acid Sulphites. G. Odrich. G.P.327,912. Papier-Fabrikant, 1922, **20**, 558.

A small percentage of sulphuric acid is added to Ca, Mg, Na, or K, or double bisulphite solution and the fibres treated at from 118°C.—128°C. for a time and finally at 150°C. —W. R.

2.—CONVERSION OF FIBRES INTO FINISHED YARNS.

(A)—PREPARATORY PROCESSES.

Cotton Waste; Utilization of——. Text. World, 1922, **61**, 2,850.

A short, general account of the methods of utilisation of cotton waste in England, with particular reference to the preparation of comber noils on the Tatham system. —J. C. W.

Flax Preparing Machinery; Possibility of Determining Analytically the Pitch and Number of Gill Pins in——. E. Acheray. L'Avenir Text., 1922, **4**, 279, 379.

A few applications are given of the formulæ obtained in the previous article (This *Jl.* Abs., 1922, **13**, 98) wherein the number, pitch and gauge of pins are worked out for certain numbers of yarns. It is also shown that by working backwards with these formulæ it is possible to determine the drafts to be given on each machine of a system to produce the best yarn with the pins with which these machines are already equipped. The results so obtained are in accordance with present-day practice. The subject is also dealt with graphically. For coarse work the gill pins of a spreader are of no great importance, never being less than 3 per inch, but in drawing frames the variation of the pins becomes greater than that of the sliver. The various series of pins of a hackling machine are discussed. There are generally 10 to 12 different pitches and gauge of pins starting from coarse; the gauge of the last series in contact with the fibres should be finer than that of the roving frame through which the fibre is going to pass in the form of sliver.

—A. H. M.

Suggestions for the Improvement of Canton Silk. Silk, N.Y., 1922, **15,** 54.

The Silk Association of America suggests that the quality of 14/16 and 20/22 denier should be improved; it is uneven and runs to fine ends. There are many long lumps, gums, slugs, etc., and the reeling defects, such as split threads, loops and hairiness, almost unfit it for American use. A systematic grading of cocoons, neater and shorter casting, and the use of fine glass guides are suggested. The number of defects is stated to be increasing.
—F. G. P.

Electrical Stopping Device. Leipziger Monatsch. Text. Ind., 1922, **37,** 88-89.

The construction and manipulation of a small device for detecting insulation defects in drawing frames with electrical stop-motion is described. The device consists of an electric bell, attached to a dry cell, and two long insulated wires terminating in a pair of handles with metal contact points. The drawing frame is systematically divided up and the parts tested separately, the ringing of the bell indicating defective insulation.—J. C. W.

Carding Loose-Dyed Cotton. Cotton, U.S.A., 1922, **86,** 513.

The following method for overcoming static electricity in the card room is described. The cotton should be washed thoroughly, dried, and when ready for a mixing spread on the floor over as large an area as possible and to a depth of 12in. The whole surface of the pile should then be sprinkled with hot water containing 2 tablespoonsful of borax per gallon of water. The pile of cotton must then be worked up and turned over with a fork. A little steam in the room will also help.
—J. C. W.

(B)—Spinning and Doubling.

Spindle Selection and Care. Cotton, U.S.A., 1922, **86,** 471-476, 479.

A general article dealing with the selection, setting-up, and care of band-driven spindles. —J. C. W.

Cotton Waste; Utilization of——. See Section 2A.

(D)—Yarns and Cords.

Yarns for Artificial Silk and Cotton Hosiery. Text. World, 1922, **61,** 3189.

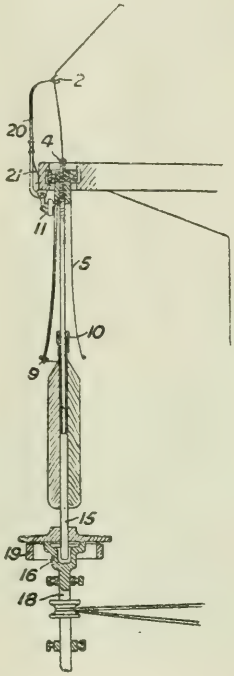
For use on a Scott and Williams 176 needle 3¾ inch machine making light weight stockings the following yarns are suggested:—For 40% artificial silk, 190 denier with 2/38's mercerised cotton; for 50%, 230 denier with 2/46's; for 60%, 280 denier with 2/56's. —F. G. P.

Patents.

Spinning Box for Artificial Silk. James Clayton, Babbacombe, England, Assr. to Viscose Co., Marcus Hook, Pa. U.S.P.1,417,455-6, 23/5/22; Appl. 11/11/20.

Spinning: Spindle-driving Apparatus; Anti-ballooning Arrangements. British Thomson-Houston Co., Ltd., London, and F. H. Clough, Hillmorton, Rugby. E.P.179,282, 1/5/22.

To spin cotton or other yarn at high speed and at the same time to avoid undue tension, it is passed to the spindle 15 through a passage 4 and inside a cap 5 concentric with and rotatable relatively to the spindle, whereby the yarn is protected from windage and is prevented from ballooning. The cap is provided with a yarn guide on the rim 9 and is slidably connected to the spindle by means of a light friction packing 10 so that, when either is rotated positively, the other tends to rotate therewith, but is braked by a friction or magnetic brake controlled by the tension of the yarn. As shown, a friction brake 11, controlled by a spring 21 and by the yarn, which passes through an eye 2 on an arm 20, is applied to the cap, but for the finest yarn a brake may be controlled by a relay operated by the yarn, or a disk of conducting-material may be mounted to rotate between the poles of an electro-magnet, the circuit of which is controlled by the relay. The spindle 15 is mounted in a step bearing 16 on a driven spindle 18, and is driven by contact of the upper face of the bearing with a disk. A ring 19 raises the disk from the bearing. Spec. 16792/15 is referred to.
—A.



Winding and Dyeing Machine. U.S.P. 1,415,964. See Section 4.

Winding Yarns. E. C. R. Marks, London (Barber-Colman Co., Rockford, U.S.A.). E.P.179,217, 1/5/22.

In a yarn-winding machine, the yarn mass being wound is unyieldingly pressed against its driving drum by means actuated by yarn-controlled means to accommodate the increase in size of the yarn mass while maintaining the pressure. The invention is described as applying to a warping machine. —A.

Combing Machine. J. Fossel, Grafton, Mass., Assr. to Alsatian Machine Co. U.S.P.1,416,951, 23/5/22; Appl. 15/1/21.

In combination with the nipper mechanisms, means for operating them alternately. —A.

Doffing Apparatus. E. R. Alderman, Holyoke, Mass. U.S.P.1,419,192, 13/6/22; Appl., 5/1/22.

Comprises pivotally mounted members adapted to be swung into position on a cap spinning machine beneath the caps to support them by engagement with their lower edges in removal from the spindles. —A.

3.—CONVERSION OF YARNS INTO FABRICS.

(A)—Preparatory Processes.

Warping Process. S. Kline. Silk, N.Y., 1922, **15**, 62.

It is proposed to use two creels in order to exchange one of full bobbins for the other of bobbins that are running off. The second creel is prepared with an extra set of reeds. One good warper with a good helper can work two machines, doing as much as three warpers with three machines by the ordinary method. A drawside winding machine should be used for rewinding skinny bobbins. By using this method even tension is assured and slack and tight ends prevented.—F. G. P.

(B)—Sizing.

Measuring Stiffness of Sized Cloth. See Section 6.

(C)—Weaving.

Loom. T. Woodhouse and J. Ireland. Text. Mfr., 1922, **48**, 139-140.

The preliminary part of an article on modern power looms for plain and twill fabrics in which an upward-beat loom is illustrated. —J. C. W.

Damask: Weaving Defects. T. Woodhouse. Text. Rec., 1922, **40**, 48-49.

The first part of an article on defects in the shaded portions of fine damasks as a result of the interrupted relation between Jacquard cards and twilling knives of twilling Jacquards. —J. C. W.

Weaving Shed Floor. Text. Rec., 1922, **40**, 58-59.

A new flooring for weaving sheds is described. The surface on which the machinery stands is made of one material and that subject to trolley and foot traffic of another. The idea can be applied to old or new floors. In the case of new floors a foundation of Portland cement concrete 4 or 5in. thick is laid first. The portions on which the looms will stand are homogeneously overlaid with a finished surface of strong, hard, granolithic composition, suitably tinted to contrast with the class of goods manufactured, thus aiding the weaver in "piecing up," etc. If the presence of moisture in the shed is considered advantageous, the floor surface occupied by the looms can be of specially porous construction. The main alleys are overlaid with a specially "armoured" mastic rock asphalt. —J. C. W.

(D)—Knitting.

Latch Needle Circular Ribbers. G. R. Merrill. Cotton, U.S.A., 1922, **86**, 547-551.

A broad outline of the principles of the latch needle circular ribber is given, and a more detailed account of a small, single feed, stationary cylinder, circular ribber. —J. C. W.

(G)—Fabrics.

Typewriter Ribbons; Manufacture of——. P. J. Hassett. Amer. Dyestuff Reporter, 1922, **10**, 403.

The best grades of ribbon fabrics are usually made from long staple Sea Island or Egyptian cotton very closely woven, running from 290-320 threads per sq. in. Natural wax and accompanying impurities of the cotton fibre and also warp size or oil accumulated in the manufacture of the fabric must be removed in finishing. The latter process generally consists of one or more boils in soda, thorough washing and treatment with malt or diastafor. The ribbon manufacturer receives the cloth from 36-40in. wide and slits it into the required ribbon width, the edges of the slit ribbon being sealed with an adhesive consisting of a glue solution to which glycerine is added. The inking of the ribbon is also described. —L. M. S.

Patents.

Knitting Machines. M. Zwicky, Wyomissing, Pa., Assr. to Textile Machine Works Co. U.S.P.1,417,290, 23/5/22; Appl., 20/1/20.

Selvage-reinforcing attachment for full-fashioned machine. —A.

Looms: Feeler Mechanism. Alonzo E. Rhodes, Hopedale, Mass., Assr. to Draper Cor. U.S.P.1,416,510, 16/5/22; Appl., 11/6/19.

A feeler mechanism for filling replenishing loom.

Looms. J. Wilkinson, Fall River, Mass. U.S.P.1,417,220, 23/5/22; Appl., 25/2/21.
Harness-operating device.

Shuttle-Throwing Mechanism. H. Stralucke, New York. U.S.P.1,419,776, 13/6/22; Appl., 12/5/21.
Comprises a spring actuated rod connected to the picker and means for disengaging a catch at the time for the picker to throw the shuttle, whereupon the spring moves the rod and picker arm for properly throwing the shuttle. —A.

4.—CHEMICAL AND OTHER PROCESSES.

(B)—Scouring and Degumming

Degumming Vat-Dyed Silk. Textiles, 1922, **20**, 50.
A Swiss process for preventing the running of the colour from vat-dyed silk when it is exposed to the action of degumming liquor is described.—L. M. S.

The Sorption of Neutral Soap by Wool, and its Bearing on Scouring and Milling Processes. See This *Jl.* (Trans.), 1922, **13**, 127.

A Standard Method for the Estimation of Soap in Wool. See This *Jl.* (Trans.), 1922, **13**, 143.

(D)—Milling.

The Sorption of Neutral Soap by Wool, and its Bearing on Scouring and Milling Processes. See This *Jl.* (Trans.), 1922, **13**, 127.

(E)—Drying and Conditioning.

Drying Chamber: Steam Consumption. F. Strauch. Papier-Fabrikant Festheft, 1922, **20**, No.23A, 57-66.
A mathematical treatment of the consumption of steam in drying processes in the paper industry. All factors affecting steam consumption are reduced to the basis of steam consumption per kilogram of paper. The whole report is intended to serve as a uniform basis for researches on the design and control of the drying chambers for the paper industry. —J. C. W.

Air Washer Equipment for Cleaning, Cooling, Humidifying and De-humidifying. See Section 7H.

(G)—Bleaching.

Holes in Artificial Silk Hosiery. Text. World, 1922, **61**, 3189.
Holes may result in the bleaching bath from undissolved lumps of sodium peroxide or from particles of iron rust. —F. G. P.

(I)—Dyeing.

Azidine Dye; Application of——. Textilberichte, 1922, **3**, 191.
Directions are given for dyeing cotton in the cold with azidine dyestuffs, or with azidine dyes in combination with other colours. —J. C. W.

Cellulose Acetate Silk; Dyeing——. C. Raglan. Dyer and Calico Printer, 1922, **47**, 206-207.
The first part of a general article on the dyeing of acetyl silk. This instalment includes the preparation of the goods and the application of basic dyes, alizarine dyes, azo dyes, rhodamines and other colours. —J. C. W.

Tungstate Lakes: Application. C. Sunder. Bull. Soc. Ind. Mulhouse, 1922, **88**, 78-79.
A new Prud'homme black process, depending on the use of tungstates, has been devised to eliminate fouling of the whites which usually occurs in the ordinary process. The advantages of tungstate lakes with regard to tannin lakes are discussed and directions given for preparing a yellow lake with auramine and a violet lake from crystal violet. —J. C. W.

Aminonaphtholsulphonic Acids; Application of——. G. R. Levi. Rev. Gen. Mat. Col., 1922, **27**, 75-76.
The gamma-acid alone has no affinity for cotton, but M-acid (1.5.7 aminonaphtholsulphonic acid) is readily absorbed by vegetable fibres. This affinity is greater if the acid is coupled than if it is diazotised, and is greatest if the diazotised acid is coupled with M-acid itself. J-acid also possesses a remarkable affinity for cotton which is greater if the acid is coupled than if it is diazotised. —J. C. W.

Colours for Autumn. Dyer and Calico Printer, 1922, **47**, 231.
The Textile Colour Card Association of the United States has issued a new list including among the greens:—Poinsettia, Chinese Green, Erin, Killarney, Kremlin and Narva. Tans are Muffin, Toast, Tiffin and Pigskin. Browns are Spice, Chutney, Mandalay, Apache and Tuscany. Bittersweet is an orange, Brickdust a copper-red. Among purples are Nuncio, Pontiff, Vatican, and Mallow. Armada and Dante are wine shades. Blues include Kashan (a Persian turquoise) and Hankow. A new red is Akbar. Gargoyle, Woodash, Fog and Lead are greys. Of 80 colours 66 are on silk and 12 on wool. —F. G. P.

Cotton Cloth; Dyeing——in Cold and Slightly Warmed Baths with Direct Colouring Matters. R. Sansone. Amer. Dyestuff Reporter, 1922, **10**, 220-222.
Dyeing cotton cloth cold saves fuel and labour. Colours such as Erica GN, Erica BN, Brilliant Purpurine, Congo rubin, Curcumine, Chrysophenine, Chicago Blues, Columbia Blue R, Heliotrope 2B, certain brands of Columbia and Zambesi Black, etc., may be used in cold or slightly warmed baths. Trials should be made by the chemist in the laboratory and then on small batches in the works. The uses of beam and jigger machines are described and their advantages compared. —L. I. R. A.

Colour Theory; The White and Black of the——in Fabric Dyeing. E. Ristenpart. Textilberichte, 1922, **3**, 208.

The author points out that the dyer does not add black and white, in the sense of the Ostwald colour equation, to his dyebath, but arranges the quantity and composition of the added dyestuff so that the black and white of the shade obtained, in the sense of that equation, agree with the black and white of the sample. Skill and practice, not calculation, enable him to do this. —J. C. W.

Indigo; Application of——. W. B. Nanson. Cotton, U.S.A., 1922, **86**, 405-408.

The first of a series of articles dealing with the history, production, and chemistry of indigo and with indigo dyeing. —J. C. W.

Cotton Foulard; Dyeing——. Text. Rec., 1922, **40**, 46.

A general account is given of the dyeing of cotton foulards. Direct colours are most generally employed for light shades and cut to a perfect white by the usual hydrosulphite discharge. For navy blues, there is a range of direct dyeing colours which, when diazotised and coupled with β-naphthol or phenylenediamine, yield beautiful shades of great fastness to light and washing. These colours are discharged with hydrosulphite. Browns are dyed with direct colours, which, when after-treated with diazotised para-nitraniline, are rendered much faster to washing. The tannin discharge method of obtaining white-on-blue effects is described. Aniline blacks are used for obtaining black foulards. —J. C. W.

Dyeing Viscose Silk. G. Emmons. Silk, N.Y., 1922, **15**, 62.

General remarks concerning the dyeing of this form of artificial fibre. Direct cotton dyes are recommended, as they involve the smallest amount of handling.—F. G. P.

Dye: Fluorescence. See Section 6.

(K)—FINISHING.

Tin Weighting in Silk. A. A. Cook. Text. World, 1922, **61**, 3,185.

In continuation of the previous article (See This *Jl.* Abs., 1922, **13**, 137) the author states that in analysing tin weighting by the stripping method experiments showed that using 2% solutions of hydrofluoric acid and sodium carbonate for three periods of 20 minutes each at a temperature between 60—70°C. gave results within 0·5% of the actual weighting put in. Higher temperatures led to degradation of the silk. Details are given of a process recommended for carrying out this analysis. Further investigation is suggested into the composition of tin-phosphate-silicate compound, the actual chemical reactions of stripping and the methods of analysis for other than tin weighting. —F. G. P.

The Weighting of Silk. W. Keiper. Textilberichte, 1922, **3**, 181.

In addition to increase in weight, it has been found that swelling of the fibre takes place on weighting, and to-day this is the more important result: in a heavily weighted black silk this can amount to 200%. Piece weighting yearly becomes more important. The tin phosphate-silicate method is carried out as follows:—The silk is slowly rotated in a centrifuge lined with hard rubber, treated with 30° Bé solution of stannic chloride for 1-2 hrs., wrung and then well washed. A 5°—7° Bé solution of sodium phosphate at 50°C. is run on the fibre, which permanently fixes the tin hydroxide and at the same time gives the silk an increased affinity for stannic chloride. This process is repeated as often as necessary; the washed silk is then treated with 3°—5° Bé water-glass solution at 50°C., silicic acid is deposited, and a considerable increase in weight occurs. Finally, the fabric is soaped, soured, washed, and dyed. By a single treatment, an increase of 5%—20% is obtained; by repeated treatments 80—100%. For black silk, the dyeing and weighting are combined. —E. B. A.

Polishing of Silk Yarns; Some Notes on the——. R. Sansone. Silk, N.Y., 1922, **15**, 40.

The effects usually desired are high polish with and without scroop, transparency and strength softness with low polish. In brush polishing machines the skeins are gradually turned during operations; brushes should be changed for different colours to avoid contamination. Skeins polished by steel cylinders are often steamed before treatment. Unless the silk contains a high percentage of moisture the polish is rarely permanent.—F. G. P.

Finish like Plush. Textiles, 1922, **20**, 41.

A French process for giving cloth the appearance of plush or leather is described and the machine used illustrated. —L. M. S.

Fireproofing Cloth. E. O. Rasser. Leipziger Monatsch. Text. Ind., 1922, **37**, 95-96.

A general account of methods employed in fireproofing. —J. C. W.

PATENTS.

Dyeing Cellulose Acetate with Acid, Basic, Mordant, Substantive, Vat and Sulphuretted Dyes. Burgess Ledward and Co., Ltd., Walkden, and W. Harrison, Worsley. E.P.179,384, 11/5/22.

Cellulose acetate goods are dyed with colloidal dye solutions prepared by adding to a solution of dye or leuco-compound a protective colloid (gelatine, casein, saponin, starch, etc.), and a precipitant (except metallic chlorides); preferably, the precipitants are bodies which are themselves absorbed by the cellulose acetate. Suitable precipitants are:—For basic dyes, a weak alkali such as ammonia, a salt of an acid metallic oxide such as molybdates, tungstates, or stannates, or an organic compound of acid character such as tannic acid or salts of phenols, naphthols, aromatic acids, hydroxyacids, sulphonic acids, etc.; for acid or direct cotton dyes, a salt of an organic base such as aniline, benzidine, dianisidine, phenylenediamines, naphthylamines, etc. Sulphur dyes are dissolved in sodium sulphide, hydrosulphite, and vat dyes in sodium hydrosulphite, the same precipitants being used as in the case of direct dyes. Examples are given of dyeing triacetate silk in baths containing:—Methylene blue, glue, and sodium stannate; magenta, saponin, and tannic acid; diamine sky blue, glue, dianisidine, and acetic acid; thional navy blue R, sodium sulphide, glue, dianisidine, and acetic acid; ciba blue 2B or indigo, caustic soda, sodium hydrosulphite, glue, dianisidine, and acetic acid. Mixed goods containing cotton may be dyed with sulphur or vat dyes as described above, the cotton threads being subsequently dyed with direct dyes. The Prov. Spec. describes also the use of salts of aluminium, barium, magnesium, etc., as precipitants for direct or acid dyes, and of oxidising agents such as air, or metal salts as precipitants for vat or sulphur dyes; it also refers to the use of alizarin dyes using metallic salts or mordants or organic bodies as precipitants. —A.

Dyeing (Union Goods). British Cellulose and Chemical Mfg. Co. and Briggs and Richardson, Spondon, Derby. E.P. 178,946, 27/4/22.

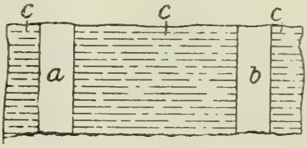
Goods containing both cellulose acetate and cellulose fibres are first dyed in the ordinary manner with substantive or other dyes, when only the cellulose fibres take up the colour, and are then subjected to partial alkaline saponification and dyeing continued at higher temperature and preferably in the same dye-bath, whereby the dyestuff previously absorbed by the cellulose fibre bleeds out and is transferred to the cellulose acetate portion. The treatment may be continued until a solid shade is obtained on the goods as a whole or until the two portions display any desired difference of shade. Examples have been submitted of dyeing of mixed cotton and cellulose acetate goods, but the cotton may be replaced by linen or other form of cellulose, natural or artificial. Specifications 169,741 and 175,486 are referred to. —A.

Weighting or Charging Silk to be Dyed Black. A. W. Schmid, Basle, Switzerland. U.S.P.1,417,206, 23/5/22; Appl., 18/2/22.

The process consists of first weighting or charging according to the usual tin-phosphate process and afterwards treating in a boiling lather or froth bath of a hæmatein solution to which chrysalides boiled up in water have been added. —A.

Woven Fabrics; Finishing, etc. C. P. A., Manchester, and H. A. Costobadie, Overdale, nr. Broadbottom. E.P. 179,260, 28/4/22.

A fabric comprising threads of nap-forming material is so woven that at parts *a*, *b* thereof threads of smooth material, such as silk or artificial silk, are floated to the surface. The fabric is submitted to raising and curling or rippling processes and the parts *a*, *b* remain flat, thus producing a pattern in conjunction with the nap-forming surface *c*. —A.



Dyeing and Waterproofing. A. O. Tate, New York, U.S.A. E.P.179,247, 26/4/22.

Cotton or silk fabric to be dyed black is impregnated as usual with an aniline salt, sodium or potassium chlorate, and preferably a metallic salt such as copper sulphate. After "ageing" by warm moist air, the fabric is rendered waterproof, and the final colour developed, by treatment as described in Specifications 19213/09 and 108,085—by impregnating the fabric with a soapy liquid such as sodium palmitate solution and an aluminium salt such as the acetate or sulphate, and passing it between electrodes, one at least of which is aluminium, while the other may be of carbon. Spec. 8318/96 and 13433/99 also are referred to. —A.

Dyeing Process. Hans Toepfer, New York, Assr. to Grasselli Chemical Co., Cleveland, Ohio. U.S.P.1,417,869, 30/5/22; Appl., 4/8/21.

In the dyeing of animal fibres, the process comprises using cobalt salts in conjunction with azo dyestuffs derived from nitro-ortho-amidophenols. —A.

Winding and Dyeing Machine. E. A. Thompson, Syracuse, N.Y. U.S.P. 1,415,964, 16/5/22; Appl., 9/1/19.

Provides for continuous operation, the thread passing across the periphery of a rotating wick supplied with dye and the rotating being continued during the entire period that the thread is in contact with the wick. —A.

Animal Fibres: Protection from injurious effect of Alkaline Liquids. P. Goldberg and A. Peters, Assrs. to Actien Ges. fur Anilin Fabrikation, Berlin, Germany. U.S.P.1,419,497, 13/6/22; Appl., 15/8/21.

The method consists in adding sulphite cellulose waste liquor to the alkaline liquids. —A.

5.—LAUNDERING AND DRY-CLEANING.

Pongee Silk; Cleaning and Dyeing——. J. Loebl. Amer. Dyestuff Reporter (from Cleaners' and Dyers' Review), 1922, **10**, 439.

The method of cleaning pongee dresses is described. Notes are also given on the dyeing of pongees. —L. M. S.

6.—ANALYSIS, TESTING, GRADING, AND DEFECTS.

Lens: "Definition." A. Mallock. Nature, 1922, **109**, 678-681.

The terms definition, resolving power and accuracy are discussed and the results of some observations on the kind of definition which can be expected in the case of the senses of sight, hearing, or touch, by which all measurements have to be made, are described. Special reference is made to judging definition and resolving power in optical instruments. —J. C. W.

Micromanometer. F. Michaud. Compt. rend., 1922, **174**, 805-806.

A new micromanometer, the sensitivity of which can be controlled and adjusted, is described. The sensitivity of this instrument is 100 times greater than that of Henry's micromanometer. —J. C. W.

Photo-Electric Cell; Application of——. H. von Halban and K. Siedentopf. Z. physikal Chem., 1922, **100**, 208-230.

An arrangement is described for measuring light absorption in solutions with the aid of photo-electric cells. By employing two cells the fluctuations of the mercury lamp forming the source of light are cut out. The cells are mutually compensating, and have therefore no other function. Measurements were made of the light absorption in solutions of potassium chromate in potassium hydroxide, equimolecular quantities of potassium chromate and copper sulphate in ammonia, azobenzene in alcohol, and anthracene in alcohol at the wave lengths of the mercury lines. —J. C. W.

Steele-Grant Microbalance: Manipulation. E. J. Hartung. Phil. Mag., 1922, **43**, 1056-1064.

Some observations on the construction and use of the Steele-Grant microbalance are recorded and sources of error are discussed. Some hints are given on the drawing of suitable silica fibres, and a device for loading and unloading the balance without undue strain and risk of breakage is described. —J. C. W.

Calorimeter. F. Barry. Jl. Amer. Chem. Soc., 1922, **44**, 902.

A new type of "closed" calorimeter and a similar type of "open" calorimeter are described. With these systems the initial conditions are perfectly adiabatic, and the total calorimetric lag for the temperature changes characteristic of long-continued operations is negligible. —J. C. W.

Laevoglucosan: Polymerisation. A. Pictet and J. H. Ross. Compt. Rend., 1922, **174**, 1113-1114.

When laevoglucosan is heated at 140° with a trace of zinc chloride, a series of polymerides is obtained, varying in complexity with the pressure under which the reaction is conducted. Thus, a dimeride is formed under 15 mm., a tetrameride under 1 atm., a hexameride under 4 atm., and an octameride under 13 atm. The more complex products resemble more and more the dextrins. —J. C. W.

Self-Standard Turbidimeter. W. G. Exton. Abstr. Bacteriology, 1922, **6**, 37.

Experiments were made with a view to utilising the obscuring power of the column of a cloudy liquid as the means of directly measuring the degree of cloudiness of the unknown suspension. It was found that direct or disappearance methods were not as sensitive as comparison or intensity methods because of the progressive weakening of the optical power of the column of cloudy liquid. These difficulties were finally overcome by the use of magnification in conjunction with targets of different degrees of fineness. The instrument works on either optical principle and with different kinds of targets. It eliminates the necessity of preparing standards by giving direct vernier readings of cloudiness on a milli-meter scale. Interchangeable targets permit specialised application, allowance for colour, etc. —J. C. W.

A "Micro-Kjeldahl" Method of Determining Nitrogen. A. R. Ling and W. J. Price. Jl. Soc. Chem. Ind., 1922, **41**, 149-151T.

A new "micro-Kjeldahl" method of determining nitrogen is described. The method was designed for the determination of nitrogen in substances containing only a trace of protein and much carbon, *e.g.*, starch and other carbohydrates. The substance is mixed with anhydrous copper sulphate and potassium sulphate, concentrated sulphuric acid and a trace of platinum tetrachloride are added and the liquid is boiled. The cooled liquid is diluted and boiled to expel any sulphur dioxide. The cold liquid is distilled with sodium hydroxide and the diluted distillate is Nesslerised. Practical details are given. —J. C. W.

Inulin: Constitution. H. Pringsheim and M. Lassmann. Ber., 1921, **54**, 1,281, and 1922, **55**, 1,409-1,414.

It is shown that a tri-acetate of inulin can be prepared which by cryoscopic methods and by Barger's method is found to have molecular weight about 2,600. Inulin, therefore, consists of nine fructose residues. The author states that this is the first case of a trustworthy determination of the molecular weight of a polysaccharide. Acetates of glycogen and of soluble starch were also prepared, but no results could be obtained for their molecular weights. —J. C. W.

Substantive Dye: Dispersivity. R. Haller and Horst Russina. Kolloid-Zeits., 1922, **30**, 249-253.

A continuation of the author's earlier work (This *Jl.*, 1921, **12**, 488). After some preliminary experiments on the estimation of dyestuffs a modification of Knecht's method was devised. This method was then applied to determine what proportion of the dyestuff employed in dyeing is adsorbed by the fibre and what proportion remains in the dyebath. The proportion of dyestuff remaining on the filter in ultrafiltration was also studied. An investigation of the quantities of electrolytes contained in the dyestuffs was made. The inorganic impurities consisted entirely of sodium chloride. Of the dyestuffs employed, namely, congo-rubin, congocorinth G and diamine blue 3 R, the congorubin and diamine blue behaved similarly and unlike the congocorinth. This is stated to be due to their lower dispersivity in aqueous solution. Further, support is given to the supposition that the position of certain groups in the molecule of compounds of otherwise similar composition influences their dispersivity. —J. C. W.

Colloidal Particle: Visibility. J. Traube and P. Klein. Physikal. Zeits., 1922, **23**, 171-173.

Directions are given for the preparation of colloidal solutions of certain crystalline substances in which the presence of ultramicroscopic particles may be manifested to the naked eye by the agency of the Tyndall cone. The particles exhibit a definite movement similar to the Brownian movement. In spite of their small dimensions they are still crystals. —J. C. W.

Cotton Research in India. Indian Central Cotton Committee. Pamphlet, pp.6.

The scope of the work of the Indian Central Cotton Committee is discussed under the following headings:—Objects; work done up to date; constructive functions; reasons why technological research is urgent; agricultural research; and the cotton cess. —J. C. W.

Hydrolysis. S. T. J. Tromp. Rec. trav. chim., 1922, **41**, 278-300.

The author has extended the work of Schoorl, who determined the specific volume of the molecule of water which enters into the hydrolysis of sucrose, to a much wider field, and has also calculated the specific refraction of this water. It is shown that these quantities are fairly constant for a given type of compound but sufficiently different (especially the specific volumes) from type to type to render their determination useful in questions of constitution. The values for specific volume and specific refraction are then given for esters, nitriles, carbylamines, nitro-compounds, anhydrides, ether-oxides, oximes, amides and acetals. Schoorl's value for the specific volume in the case of sucrose was 0·67, which therefore agrees with the ether-oxide structure.—J. C. W.

Carbohydrate Culture Medium; Preparation of——. H. R. Baker. Abstr. Bacteriology, 1922, **6**, 3.

A new method is described for the qualitative determination of acid or alkali production by bacteria. Brom-thymol-blue is substituted for litmus as an indicator in carbohydrate media. A dilution of 1 in 41,666 of the indicator gave the most desirable concentration for colorimetric comparison. The advantages of this indicator are pointed out. —J. C. W.

Absorptiometer. L. Moser. Z. anorg. Chem., 1922, **121**, 313-318.

The apparatus described is designed on the closed space principle of the Hempel pipette, for the volumetric and gravimetric estimation of gases. It is suitable for technical and also for accurate gas analysis. The estimation of one, or several, gases is carried out by absorption with a measured volume of standard solution, and subsequent volumetric or gravimetric estimations. The residual gas can also be measured. —J. C. W.

Amylase: Adsorption. J. Effront. Physiol. Abstr. (from Compt. rend. soc. belge de biol., 1922, 9-11), 1922, **7**, 87.

Filter paper retains ptyalin, the degree of absorption increasing with temperature. The active substance cannot be removed from the filter paper either by means of water or sugar solutions, but it passes into solution again in the presence of sodium chloride or starch paste. Certain plant juices which are inactive towards starch become very active after filtration. —J. C. W.

Adsorption. Nikolai Schilov. Z. physik. Chem., 1922, **100**, 425-462.

The study of the adsorption of electrolytes by charcoal has been extended to adsorption by aluminium oxide, ferric oxide, manganese dioxide, peat, wool and finely divided metals. The coagulation of the following sols by electrolytes has also been investigated. :—Mastic, ferric hydroxide, manganese dioxide, arsenic trisulphide, antimony trisulphide, charcoal suspended in potassium hydroxide and tannin, and ferric oxide suspended in hydrochloric acid. The results of this work support and extend those presented in the previous paper (1920). —J. C. W.

Ultra-Microscope Cell. F. Fairbrother. Jl. Amer. Chem. Soc., 1922, **44**, 1,071-1,072.

A cell for the observation of colloidal solutions for use with sub-stage ultra-condensers is described. The method of using a hemacytometer slide for the estimation of the number of particles in a colloidal solution is inconvenient because it is necessary to remove the slide and to readjust the optical arrangement in order to examine fresh samples of the solution. The apparatus described enables a series of solutions or of samples of the same solution to be passed through the cell without disturbing the adjustment. —J. C. W.

Inulin: Constitution. H. Pringsheim and A. Aronowsky. Ber., 1922, **55**, 1,414-1,425.

Further work on the constitution of inulin is described by which it is shown that inulin is the association product of a three times polymerised anhydro-tri-fructose. The fructose residues are most probably present in this anhydro-tri-fructose in the form of the so-called γ-fructose which probably contains an ethylene oxide ring. —J. C. W.

Amylase: Characterisation. J. Effront Physiol. Abstr. (from Compt. rend. soc. belge de biol., 1922, 12-13), 1922, **7**, 87.

The amylases from different sources can be characterised according to the following distinctive properties:—Solubility in water, solubility in a solution of sodium chloride, solubility in starch paste, optimum temperature, ratio between the liquefying power and the saccharifying power, action on achroodextrin, degree of resistance to the chemical action of the medium, thermo-stability. —J. C. W.

Malakograph. C. Gerhardt. Chem. Zeit., 1922, **46**, 386.

A new apparatus is described by means of which a graphic record of the course of the softening of paraffins, waxes, pitches and asphalts may be obtained. It is shown that the curves recorded by the instrument are always the same and are characteristic for the same substance. They portray the whole softening process with great accuracy and give, therefore, a much better basis for judging these materials than the melting point or softening point. —J. C. W.

Mercury Pyknometer. W. Biltz. Z. anorg. Chem., 1922, **121**, 260.

The apparatus consists of a T tube to the under end of which is fitted an elongated pyknometer vessel by means of a ground glass joint. One arm of the T tube leads to a manometer and the other to a dropping funnel containing mercury. When determining density, the substance to be tested is weighed in the detachable vessel either under carbon dioxide or in a vacuum. The pyknometer is then evacuated and mercury is allowed to drop slowly from the funnel on to the substance. When the pyknometer is two-thirds full atmospheric pressure is restored, the pyknometer is removed, filled up, closed with a capillary stopper, and maintained at 25° for 20 minutes. Care must be taken that the substance does not rise to the surface of the mercury, and two methods are described by which this may be prevented. —J. C. W.

Electro-Osmosis. P. Bary. Chim. et Ind., 1922, **7**, 640-649.

A general account is given of electro-osmosis and its application in industrial processes, including the manufacture of paper pulp and the purification of cellulose derivatives. —J. C. W.

Leather: Moisture Content. F. P. Veitch. Jl. Assoc. Off. Agric. Chem., 1922, **5**, 388.

The effect of atmospheric humidity and temperature on the determination of moisture in leather and tanning materials has been studied. It is found that the atmospheric humidity existing at the time of the determination may affect the moisture result as much as 0·5%, and it is believed that this is true of practically all organic materials. Though the effect is observable in the vacuum oven it is not quite as marked as when drying is done in the ordinary hot-water oven.—J. C. W.

Self-Standard Colorimeter. W. G. Exton. Abstr. Bacteriology, 1922, **6**, 37.

The application of the self-standard turbidimeter to colorimetry is described. A rapid, accurate and simple spectroscopic method of colorimetry has been devised which eliminates the need of freshly prepared standards. When the light filter and depth in millimetres at which a particular standard is absorbed are once established, the unknown is estimated by pouring it in the cup and racking up the plunger to the point where the colour disappears. —J. C. W.

Alkali-Soluble Cellulose. E. Knoevenagel and H. Busch. Cellulosechemie, 1922, **3**, 42-60.

When viscose-cellulose containing its normal amount of moisture is treated with hydrogen chloride gas at the room temperature, it is converted into a cellulose which dissolves completely in cold, dilute sodium hydroxide. Other forms of cellulose, such as that obtained by the hydrolysis of cellulose acetate, or by mercerising cotton do not behave in the same way. The preliminary role played by the viscose process is imitated, however, by heating air-dried cellulose with glycerol, or, better, xylene, at 120-140°, subsequent treatment under the above conditions leading to a cellulose which is very largely soluble in dilute alkali. The properties of the alkali-soluble cellulose are discussed fully. Analyses agree with the formula $(C_6H_{10}O_5)_3.H_2O$, viscose-cellulose corresponding with $C_6H_{10}O_5$ and hydrocellulose with $(C_6H_{10}O_5)_6.H_2O$. It has a very high copper number, about 13·5, and in many ways resembles oxycellulose, although it is not identical with it. —J. C. W.

Sulphate Cellulose Production. W. Schacht. Papier-Fabrikant Festheft, 1922, **20**, No.23A, 71-79.

The causes of unpleasant smells which arise in the manufacture of sulphate cellulose are discussed. The recovery of dissolved salts from the viscous liquors obtained in the process is the chief source of bad odours and a detailed description is given of the most satisfactory arrangement of the plant and method of working for bringing about a reduction of the nuisance. —J. C. W.

Viscose Cellulose; Hydrolysis of——. E. Knoevenagel and H. Busch. Cellulosechemie, 1922, **3**, 42-60.

A study of the hydrolysis of a viscose-cellulose by various means, especially methods analogous to those employed by Girard (1881) for the production of hydrocellulose. The aim of the investigators was the preparation of a cellulose completely soluble in cold, dilute sodium hydroxide, and it was found that moisture content and temperature were the controlling factors in the process. The best results were obtained by treating the material containing its normal amount of moisture (11·5%) with hydrochloric acid gas until it contains about 4—10% of the acid, and leaving for about 12 hrs. at room temperature. The product is completely soluble in cold, dilute sodium hydroxide, but may be recovered from the solution without loss on acidification. —J. C. W.

Oxidised Cellulose; Some Observations on the Behaviour of——. E. Knecht and F. P. Thompson. Jl. Soc. Dyers and Col., 1922, **38**, 132.

In the initial stages of oxidation of cellulose by permanganate in cold acid solution, the rise in copper number is nearly proportional to the amount of oxidant used up. After the use of a half atomic proportion of oxygen the rise in copper number is very gradual. The acetylation of oxidised cellulose was not found to give any indication of the effect of oxidation on the hydroxyl groups of cellulose. This was due to the very great reduction in the yield; highly oxidised cellulose gives a high yield of water soluble products on acetylation. When nitrated under identical conditions, oxidised cellulose gives products containing considerably less nitrogen than cellulose, and it is inferred that oxidation results in a suppression of the hydroxyl activity. Owing to the strong reducing action of the oxidised cellulose, it was not found possible to obtain a labile nitrate. —J. C. W.

Amylocellulose: Constitution. G. Malfitano and M. Catoire. Compt. rend., 1922, **174**, 1128-1130.

The authors describe experiments in support of their suggestion that amylocellulose may be considered as a compound of silicic acid and amylose. They believe that the relation between the silicic acid and the carbohydrate may be represented by the formula $(Si\ O_3\ (C_6H_{10}O_5)n\ )H_2$. The remarkable resistance of amylocellulose to hydrolysis should then be attributable to the presence of silica. —J. C. W.

Dye: Light Absorption. P. Lasarev. Z. physikal. Chem., 1922, **100**, 266-270.

A comparison has been made of the quantity of light absorbed by films of dyes of the cyanine type, either alone or dissolved in collodion, at ordinary temperatures and at the temperature of liquid air. —J. C. W.

Wood Cellulose; Estimation of——by means of Chlorine in Carbon Tetrachloride. E. Heuser and H. Casseus. Papier-Fabrikant Festheft, 1922, **20**, No.23A, 80-93.

Practical details are given of a method for estimating the cellulose content of wood and other raw materials by means of a saturated solution of chlorine in carbon tetrachloride. An apparatus is described for carrying out the chlorination under the influence of artificial light and thus shortening the time factor. It is shown that the time factor is also shortened by using very moist wood sawdust for the first chlorination. It was ascertained experimentally that a previous extraction of the raw material with benzene and alcohol is unnecessary when this method is used. Details are given of an apparatus for simplifying the transference of the reaction mixture to the Gooch crucible and the reverse transference for further chlorination. Results of a comparative investigation of the properties of cellulose prepared by this new method and by the direct methods are described. —J. C. W.

Measuring Stiffness of Sized Cloth. A. H. Grimshaw. Text. World, 1922, **61**, 2965-2966.

A description is given of the Grimshaw test apparatus for comparing the stiffness of sized cloth. It also affords a method of comparing the stiffening values of various sizing materials. A flat board, to which is pasted a sheet of graph paper, is erected in a vertical position. A block of wood is mounted at the upper left-hand corner of the sheet and covered by a second similar block. Prepared strips of cloth are placed, singly, between these blocks, and a different length is allowed to extend over the graph paper for each test. A reading is then taken of the abscissa, which shows the extension, and the ordinate, which shows the drop. This procedure is repeated until 6in. have been tested and four strips of each sample are used. The method, therefore, gives an indication of the ability of the cloth to sustain its own weight when extended various distances from the clamping blocks. Graphs are reproduced showing tests on grey goods and the same cloth with two different finishes. —J. C. W.

Wood: Constituents. O. Adler. Biochem. Zeits., 1922, **128**, 32-34.

If small pieces of wood are warmed in a concentrated solution of phenylhydrazine hydrochloride in concentrated acetic acid, the wood gradually assumes an intense green colour. The author deduces that this is due to the presence of an anethole derivative in the wood, and describes a number of parallel reactions. —J. C. W.

Colour: Theory. F. Weigert. Z. physikal. Chem., 1922, **100**, 537-565.

A contribution to the theory of colour vision from the physico-chemical point of view. —J. C. W.

Staple Diagram; Preparation of——. K. Berndt. Deut. Faserstoffe (from Text. Forschung, 1921, No.4, 197-198), 1922, 4, 43

A simple process is described for preparing staple diagrams by counting the number and measuring the lengths of individual fibres. A carefully pulled tuft of fibres is laid on a board covered with velvet and gently pressed down with a microscope slide, care being taken not to disturb the arrangement of the fibres. The slide is moved so far to the right that the longest fibres protrude about 1 mm., then, by means of a pair of fine tweezers one or more of the fibres can be removed from under the slide and covered with another slide carrying a millimetre scale. In this way, the whole tuft may be analysed. By this process it is said to be possible to separate and measure over 1,000 hairs in 4 or 5 hrs. —J. C. W.

Wood Cellulose; Hydrolysis. G. Meunier. Compt. rend., 1921, **174**, 468-470.

The action of mineral acids on crude cellulose has been studied on a commercial scale. Fir wood was agitated with mineral acids of varying concentration, for varying lengths of time at different temperatures. The volatile products were carried over in a current of steam which was bubbled through a suspension of chalk and subsequently condensed. The results of the experiments are tabulated, and it is shown how two curves may be drawn representing the equilibrium between the formation and simultaneous destruction of the reducing substances produced in the reaction. Some methods for utilising the by-products of the decomposition of crude cellulose are indicated. —J. C. W.

Cellulose; Studies on——. II. A New Form of the Hydrogen Capillary Viscosimeter. M. Nakano. Jl. Soc. Chem. Ind. (from Jl. Chem. Ind., Japan, 1921, **24**, 1395-1398), 1922, **41**, 366A.

A modified form of hydrogen capillary viscosimeter is described, especially suitable for cuprammonium solutions of cellulose. It consists of a stoppered glass vessel provided with two branch tubes, one at the top extending vertically upwards and connected by a side tube with a supply of hydrogen, and the other at the bottom connected with a vertical capillary surmounted by a small bulb. The tube at the upper part of the bulb is provided with a side outlet for hydrogen, and its upper end is connected with the upper end of the other branch tube by rubber tubing. Air in the apparatus is displaced by hydrogen, the cellulose and cuprammonium solution are introduced, and the apparatus is shaken to dissolve the cellulose and then immersed in a thermostat. The solution is forced up into the capillary bulb by pressing the rubber tubing. —J. C. W.

Soap; Colloid Chemistry of——. M. H. Fischer. Kolloidchem. Beihefte, 1922, **15**, 3-102.

A comprehensive article on the colloid chemistry of soaps and soap manufacture. The following points are discussed:—The manufacture of soaps; the system soap-water; the system soap-alcohol; soap in other non-aqueous solvents; the general theory of lyophilic colloids; definition of hysteresis, swelling, liquefaction, syneresis, gelatinisation power, solvation power and sols; the reaction of soaps towards indicators; the physical state of soap mixtures; reversibility in soaps; the salting out of soaps; the frothing, emulsifying, and cleansing action of soaps. —J. C. W.

Dye: Fluorescence. S. I. Vavilor and W. L. Levschin. Physik. Zeits., 1922, **23**, 173-176.

The authors have repeated the work of Weigert on the polarisation of fluorescent light by the majority of the typical fluorescent dyestuffs. Using fluorescein, rhodamine-S, rhodamine scarlet G, rhodamine B extra, aesculinum, chlorophyll in ether solution, erythrosine, and rose Bengal they have shown that in all cases there is either no polarisation or at most only a slight trace. Their conclusions are therefore directly opposed to those of Weigert. Further, the effect observed in the exciting light is similar to the Tyndall phenomenon. Weigert's conclusions may therefore be explained by the colloidal state of his dyestuffs. —J. C. W.

Cellulose Acetate; Technical Analysis of——. O. Torii. Jl. Soc. Chem. Ind. (from Jl. Chem. Ind., Japan, 1922, **25**, 118-131), 1922, **41**, 367A.

From a comparison of the methods of Green and Perkin, Ost, Woodbridge, Barthelemy, Eberstadt, and Barnett for the technical analysis of cellulose acetate the author concludes that Eberstadt's method is the best in principle. The following procedure is recommended:—0·2—0·3 grms. of the sample is moistened with a small quantity of alcohol, to which 10 c.c.s. of normal alkali solution is added, the mixture left for about 1 hr. with frequent shakings, at room temperature, and the remaining alkali is then titrated with normal acid. —J. C. W.

Density Determination of Liquids. R. Saar. Chem. Zeit., 1922, **46**, 433-435.

A logarithmic table is given for the conversion of density results obtained by pyknometer measurements from one standard of reference to another. The method of using the table is described and the physical facts on which it is based are discussed briefly. —J. C. W.

Gelatin; Testing——. R. E. Doolittle. Jl. Assoc. Off. Agric. Chem., 1922, **5**, 343-346.

Methods of determination of moisture, ash, total phosphorus, nitrogen, arsenic, copper, lead, zinc, polariscopic constants, and sulphur dioxide in gelatin are described. —J. C. W.

Cotton Hair. W. L. Balls and H. A. Hancock. Proc. Roy. Soc., 1922, B.**93**, 426-440.

The authors summarise the results of observations on the structure of the cotton hair, made subsequently to the recognition of growth rings in the cell-wall. The following conclusions are drawn:—A spiral fibrillar radial structure exists in every growth-ring of the cell-wall of the cotton hair; the simple pits of the cell-wall are a special case of this general structure; the pattern of the spiral appears to be predetermined during growth in length; this pattern is preserved through all the growth-rings of the secondary wall thickening; the number of fibrils in cross section of one hair is of the order of 1,000 upwards; the pattern (direction, reversal and pitch) of these spirals seems to be the major determinant of the externally visible convolutions of the hair; there are indications that the unknown cellulose-aggregates, which compose any one spiral fibril, have a definite geometric conformation, suggestive of stereo-isomerism; attempts to elucidate cellulose structure further, as by X-rays, will probably have to take into account this spiral fibril arrangement. —J. C. W.

Chemical Spectrometer. Dyer and Calico Printer, 1922, **47**, 209.

The new spectrometer is similar in appearance and size to a microscope. A telescope has in its eyepiece a slit and small autocollimating prism for introducing the light. After passing through the object glass the rays of light pass to a 30° prism which is silvered on the back surface. The light then retraces its path through the object glass to the eyepiece by means of which the spectrum is viewed. The prism is mounted on a table provided with a lever, and is rotated by means of a micrometer screw pressing against the lever. A drum is attached to the screw on which is engraved the scale of wavelengths. The index moves along a helical slot. For investigations of arc spectra, an arc taking about 2½ amps. is sufficient. —J. C. W.

Provisional Method on Fastness to Washing, Soaping, Laundering and Fulling of Dyed and Printed Cotton against White Cotton. Amer. Dyestuff Reporter, 1922, **10**, 443.

The following tests are outlined:—Fastness to boiling soap and soda; fastness to laundering; fastness to mild washing and soaping. —L. M. S.

Wood: Decay. H. Schmitz. Physiol. Abstr. (from Jl. Gen. Physiol., 1921, **3**, 795-800). 1922, **7**, 142.

The following enzymes were found present in *Polyporus volvatus*:—Diastase, sucrase, maltase, lactase, raffinase, inulase, hemi-cellulase, cellulase, glucosidase, esterase, katalase, and rennin. In *Fomes igniarius* urease was found in addition. —J. C. W.

Cellulose; Modified——and its Properties. E. Knoevenagel and H. Busch. Cellulosechemie, 1922, **3**, 58-59.

A summary is given of the following factors, as far as they are known:—Solubility in water, dilute sodium hydroxide, ammonium hydroxide, concentrated sulphuric acid, concentrated hydrochloric acid, "cuprammonium," zinc chloride, and zinc chloride-hydrochloric acid; colouration with dilute sodium hydroxide, zinc chloro-iodide, and iodine in potassium iodide; reduction of Fehling solution (copper number, hydrolysis number); behaviour towards faintly alkaline phenolphthalein and phenylhydrazine; behaviour on drying, acetylation, benzoylation, alkylation, and nitration; and effect of the viscose reaction. The materials listed are cotton cellulose, mercerised cellulose, viscose cellulose, hydrolysed cellulose acetate, Chardonnet and Pauly silks, Girard's hydrocellulose, parchment, cellulose precipitated from solution in sulphuric acid, Guignet cellulose, "hydral-cellulose," "acid-cellulose," chlorate and bleaching powder oxycellulose, α-, β-, and γ-oxycelluloses and alkali-soluble cellulose. —J. C. W.

The Rational Use of Filter Papers. E. J. Guild. Chem. Trade Jl., 1922, **70**, 721.

Notes are given on filter-paper ash, ordinary grade filter papers and acid-washed filter papers, the surface and colour of filter papers, and on the action of acids and alkalies on filter paper, concluding with practical hints. —L. M. S.

Determination of the Flexibility of Textile Fibres. F. Heim and O. Roehrich. Experiment Sta. Rec. (from Bull. Agence Gén. Colon. France, 1920, **13**, 1209-1216), 1922, **46**, 230.

The tensile strength of the individual filament is determined before and after knotting. The loss of resistance to breaking after knotting is considered a fairly accurate index of flexibility. Figures are given for flax, agave, ramie, hemp, jute, phormium and a number of other fibres. Tests with a torsiometer, while less accurate, corresponded in general with those obtained by the foregoing method. —W. R.

Colour Fastness to Light. Textiles, 1922, **20**, 18.

The Fade-Ometer, by means of which standard tests to colour fastness to light are made, is described and illustrated. —L. M. S.

Theory and Practice of Cellulose Hydrolysis. H. Magnus. Experiment Sta. Rec., 1922, **46**, 203.

A compendium of information on cellulose hydrolysis which is the outcome of investigations carried out at Berlin during the war on substitute feeding stuffs. Descriptions of technique are given and various methods of quantitative determination of the extent of hydrolysis and of the crude fibre are dealt with. —W. R.

Note on the Analysis of Textiles: Preparation and Microscopic Examination of Fibres. M. Pontio. Chim. et Ind., 1922, 7, 667-668.

Refers critically to the methods of Schacht and of Vétillard, and describes a modified method consisting in boiling in charges of 2% caustic soda followed by sodium hypochlorite, washing in distilled water and then applying iodine and glycerine-sulphuric acid. —W. R.

A Standard Method for the Estimation of Soap in Wool. See This *Jl.* (Trans.), 1922, **13**, 143.

The Sorption of Neutral Soap by Wool, and its Bearing on Scouring and Milling Processes. See This *Jl.* (Trans.), 1922, **13**, 127.

A Micrological Study of the Fleece of the Blackface Lamb. See This *Jl.* (Trans.), 1922, **13**, 149

7.—BUILDING AND POWER.

(H)—HUMIDIFICATION.

Air Washer Equipment for Cleaning, Cooling, Humidifying and De-humidifying. Text. World, 1922, **61**, 2975-2977.

A description of an air washer equipment and conditioner. Air from the intake is passed to the tempering coils where the temperature is raised, then to the diffusers, next to the spray chamber where the turbo-atomiser is in operation, then to the eliminator plates and the re-heating coils, where the temperature is regulated to the exact requirements before the air enters the distributing ducts; lastly, it passes to the Plexiform fan, which draws the air through the washer and delivers it clean and properly conditioned to the distributing ducts.—J. C. W.

8.—DESIGN.

Design: Microscopic Growth Phenomena. H. Schenk. Textilberichte, 1922, **3**, 171-174, 199-202.

Natural growth forms, such as the microscopic appearance of crystal aggregates, snow flakes, mineral formations, etc., are recommended as a basis for the design of artistic fabrics. Some illustrations are given. The preparation of microscope slides by the evaporation of organic salt solutions in conjunction with dyes, by means of sublimations, and the production of Liesegang rings, osmotic growth phenomena, and rosette formations are described. —J. C. W.

9.—COMMERCE, ECONOMICS, LABOUR, ORGANISATION, COSTING, &c.

Paraguayan Exports of Wool Declining. U.S. Commerce Reports, 1922, May 29, 565.

Only 3,168 kilos of wool were exported from Paraguay in the first nine months of 1921. This total is very small considering that shipments in the six preceding years averaged considerably over 62,000 kilos annually. The estimated number of sheep in Paraguay is 1,100,000.—L. M. S.

Turkey: Textile Market. Bd. of Trade Jl., 1922, **108**, 733.

Despite the adverse exchange, the United Kingdom still retains its supremacy in the textile market, with the exception of certain lines, such as cabots and silk goods. Competition from Italy, however, has been particularly formidable, especially in flannelettes and printed cotton goods, voiles, etc. German competition is not at present of any great importance. Details of the trade in woollen goods, hosiery, cabots and cotton goods are given. —L. M. S.

Importers and Exporters; Manchester Association of——. See This *Jl.* (Proc.), 1922, **13**, 131.

Industry; The Human Element in——. See This *Jl.* (Proc.), 1922, **13**, 124.

Economics in Organisation of Textile Factory Layouts. See This *Jl.* (Proc.), 1922, **13**, 121.

10.—MISCELLANEOUS.

German Cloth-Measuring Innovation. U.S. Commerce Reports, 1922, May 22, 470.

A paper tape measure, about ½ inch in width and marked off in yards and metres, is being rolled into German bolts of cloth arriving at Montevideo. This innovation enables the salesman to tell at a glance the quantity of cloth remaining in the bolt and also preserves the cloth in better condition than when unrolled and re-rolled as required in the usual method of measuring. —L. M. S.

Industrial Organic Odours; The Elimination of——. Y. Henderson and H. W. Haggard. Jl. Ind. Eng. Chem., 1922, **14**, 548-551.

The use of very small quantities of chlorine gas for destroying offensive odours attendant on industrial operations is recommended. An example of its effective use is instanced. —L. I. R. A.

ABSTRACTS

1.—FIBRES AND THEIR PRODUCTION.

(B)—ANIMAL.

Pusht-I-Kuh × Hashtnagari Sheep at the Agricultural Experiment Station, Peshawar. W. Robertson Brown. Agric. Jl. India, 1922, **17**, Pt.3, 264-270.
Describes crosses made between the two breeds of sheep, indicating the superiority of the cross. —W. R.

Crossbred Wool and B.A.W.R.A. See Section 9.

B.A.W.R.A.: Stocks and Disposals. See Section 9.

Wool Exports from Chungking, China. See Section 9.

Wool Fibre Measurement. See This *Jl.* (Trans.), 1922, **13**, 157.

(C)—VEGETABLE.

Plants; A Simple Method for Growing——. J. M. Brannon. Experiment Sta. Rec. (from Amer. Jl. Bot., 1921, **8**, 176-178), 1922, **46**, 628.
Results are briefly detailed of growing plants, including flax, in the dark in liquid cultures. —L. M. S.

Application of Neon Lamp. Experiment Sta. Rec. (from Landw. Jahrb., 1919, **52**, Erganzungsb. 1, 76-78), 1922, **46**, 640.
In studies conducted at the Dahlem Station it was found that tomato and cucumber plants forced during the night and during cloudy days with the light of neon electric lamps gave notably increased yields as compared with control plants grown under normal conditions in the same house. A repetition of the test in which neon lamps were placed in that part of the house previously used as control resulted in similar differences in yield in favour of the artificially forced plants. The superiority of the neon light over other forms is believed to lie in its fiery red colour and in the nature of the rays, which are claimed to be readily absorbed by the chlorophyll of the plants. —J. C. W.

Soil Colloid. N. E. Gordon. Science, 1922, **55**, 676-677.
The author puts forward a new view of the origin of soil colloids based initially on the constant hydrolysis of the salts contained in the outer layer of soil particles, many of which consist of hydrated silicates surrounded by a water-film. —J. C. W.

Plant Poisoning. J. H. Priestley. Ann. Appl. Biol., 1922, **9**, 146-155.
The toxic action of traces of coal gas on plants is traced to the presence of unsaturated hydrocarbons which, in the case of root or etiolated stem, inhibit the formation of a functional primary endodermis. The practical significance of the work lies in the fact that definite diagnostic features may now be sought for when injuries to plants are suspected to be due to gas poisoning. —J. C. W.

Water Stress Behaviour of Pima Cotton in Arizona. C. J. King. U.S. Dept. Agric., Bull. 1,018.
Deals with experiments conducted in the Salt River Valley, Arizona, during 1919. The normal growing season for cotton is short; the mean period of maturation of 3,000 bolls of Pima was 68 days. Great vegetative growth was accompanied by the most frequent "Water Stress," and in such cases recovery was more slow. The root system of the plants was studied in relation to the results obtained in wilting. It is concluded that there are indications of an internal physiological reaction resulting from prolonged water stress in the plant tissues which tends to inhibit their response and recovery when more favourable conditions are restored during later development. —W. R.

Meade Cotton, an Upland Long-Staple Variety replacing Sea Island. G. S. Meloy and C. B. Doyle. U.S. Dept. Agric., Bull. 1,030.
Describes Meade cotton as a variety capable of being substituted for Sea Island cotton, which is rapidly disappearing owing to the boll weevil. The characteristics of the variety are described, supply of seed discussed, and the history of the experiments with the variety since 1917 is dealt with. Methods of cultivation and the results of spinning tests are also given. —W. R.

The Boll-Weevil Problem. W. D. Hunter and B. R. Coad. U.S. Dept. Agric., Farmers' Bull. 1,262.
A general account is given of the boll-weevil problem in the United States. Full directions for carrying out dusting with calcium arsenate are given. —W. R.

Boll Weevil. D. R. Coker. Cotton (from Commerce and Finance, N.Y.), 1922, **28**, No.1,336, 12.
The efficacy of a mixture of calcium arsenate and molasses for destroying boll weevils has recently been proved by experiments. —L. M. S.

The Weevil Fauna of South India, with Special Reference to Species of Economic Importance. T. V. Ramakrishna Aygar. Agric. Research Inst., Pusa, Bull. 125.

A systematic paper on weevils in India. In each case the hosts on which the weevils occur are noted, fibre plants, such as jute and cotton, are mentioned, and the degree of damage caused by the pest is mentioned. —W. R.

Brazilian Cotton Experiment Stations. U.S. Commerce Reports, 1922, June 26, 817.

Cotton experiment stations of the States of Maranhao, Piauhy, Rio Grande do Norte, and Pernambuco during 1921 produced 43,159 lbs. of cotton seed, a quantity sufficient for planting 3,224 acres. The official Cotton Service has also purchased and distributed about 100,000 lbs. of seed and has disinfected with its equipment 224,000 lbs. for planters. The establishment of an experiment station in the State of Bahia has been recommended, and a subsidy for the maintenance of a cotton service in the State of Sergipe during 1922 has been authorised. —L. M. S.

Guatemala: Extension of Cotton Cultivation. Bd. of Trade Jl., 1922, **109**, 47.

Cotton growing is beginning to receive special attention in Guatemala. Cultivation has hitherto been carried out only on the Pacific slope around Mazatenango, and the entire crop has been taken for local needs. The cotton grown is native long staple, and it is ginned in a new establishment at Mazatenango. It is probable that there will be in future a small exportable surplus from this region. On the Atlantic slope at La Reforma, near Zacapa, an experimental crop of about 270 hectares has recently been planted, and in addition an area of over 1,000 hectares prepared for cultivation. A ginning plant has been established on the estate, and it is reported that a crop of 6,000 quintals of long staple Peruvian cotton is being produced this season. The Zacapa district is peculiarly suitable for cotton growing. The climate is extremely dry—rain falling only between May and November—and sufficiently hot. The chief problem in Guatemala is lack of labour. It is understood that a Manchester firm are undertaking experiments with Sakellarides Egyptian cotton, a supply of this seed having been sent out early last year. —L. M. S.

Ginning Machinery. S. E. Gillespie. Reprint from Amer. Soc. Mech. Engineers, May 8-11, 1922, p.25.

The author describes the development of the modern saw gin from Whitney's original apparatus. The various devices employed in the different stages of cotton ginning are described and illustrated, and information for designers, regarding dimensions, relative proportions, speeds of operation, etc., is included. —J. C. W.

"Arghan." M/c Guard. Commercial, 1922, **5**, July 13, 34.

This new textile fibre was originally discovered in the leaves of a plant akin to the pineapple growing in the S. American wilds, but the difficulties of transport were at first insuperable. A large quantity of roots was conveyed to the Federated Malay States, where 30,000 acres of land were set apart for its development: the Ceylon and Indian Governments now propose to grant similar large tracts. The leaves split up into innumerable white, silky fibres, without any degumming or retting. Tests have shown that the fibres are 50% stronger than hemp, are adamant to sea water, have an extensibility of 1·8—2·5% and a breaking strain of 3·0—6·1 grs. per denier. Both the cloth which has been made from the fibre and the yarns take dye permanently. Suggested uses for the fibre are:—(1) For replacing cotton in the making of heavy canvases; (2) for cordage, fishing nets, twines, tapes and beltings. (Note.—The botanical name of " Arghan " is as yet undetermined.—L.M.S.) —L. M. S.

Cotton Pests in Brazil. U.S. Commerce Reports, 1922, July 3, 21.

The curuquere (leaf worm) is reported to have invaded, with considerable damage, the cotton fields of Sao Paulo. Cool weather favours the spread of the pest, but efforts are being made to combat it. —L. M. S.

Cotton Cultivation in S. Africa. Leipziger Monatsch. Text. Ind., 1922, **37**, Sonder No. II., 19.

The earliest experiments on cotton cultivation in South Africa were made in 1863, but cotton was only grown till 1882. The attempt was renewed in 1910-1911, and the production of cotton has since increased steadily, although the seed at the disposal of the planters is not good and the importation of seed is strictly supervised to avoid the introduction of diseases and pests. Egyptian seed is excluded entirely. Although the pink boll-worm and the Mexican boll weevil are absent, the Sudan boll-worm does considerable damage. Rustenburg is the chief cotton-growing centre, and extensive ratooning experiments have been made at the experiment station there. Results show that ratooning is not to be recommended. The cotton varies greatly in staple length, but there seems to be no reason why a uniform 1·2 inch staple cotton should not be obtained. —J. C. W.

Calcium Arsenate; Application of——. H. W. Ambruster. Chem. and Met. Eng., 1922, **26**, 1155-1158.

The economic situation of the calcium arsenate industry is discussed, and it is shown that its use as a cotton insecticide depends on a large number of factors, including the available supply of white arsenic. —J. C. W.

Standardising American Cotton: Mebane Triumph Cotton. Text. Rec., 1922, **40**, 44.

Texas farmers representing 5,000 acres of cotton have subscribed to an agreement by which they will plant only selected Mebane Triumph long-staple cotton seed, and a ginner has agreed to handle only the cotton from these farms, so as to prevent mixing of the seed and lint with that of other varieties. The lint will be pooled, graded by experts, and sold at a premium because of its length of staple and uniformity.
—J. C. W.

Egyptian Cotton; Origin of——. A. E. Blandenier. Bot. Centr. (from Bull. Soc. Vand. Sc. Nat., 1921, **53**), 1922, **143**, 243.

The cultivated Egyptian cottons can all be referred back to two species, viz., *G. barbadense* and *G. punctatum*, which were crossed with other types. The pure strains are very seldom found. It is difficult to distinguish between the numerous types of cottons, an examination of the seed hairs being the best method of doing so. All forms represent hybrids which is also revealed by an examination of the seed.
—J. C. W.

Cotton Pest. N. Patouillard. Rev. Appl. Mycology (from Rev. de Bot. Appliquée, 1922, **2**, 41-42), 1922, **1**, 216.

A number of cotton plants (*Gossypium punctatum*) received from Dahomey were found to be severely attacked by a fungus which the author believes to be a local form of *Botryodiplodia theobromae*. The infected plants were stunted, the leaves being few and misshapen, and the fruit imperfectly developed, black, and remaining closed. The lint was in a shapeless agglomeration, often completely blackened and always unfit for use. The fungus is believed to be a wound parasite, and to be found throughout hot regions, occurring with slight variations on a large number of the most diverse host plants.—J. C. W.

"Verticillium" Wilt. W. F. Bewley. Ann. Appl. Biol., 1922, **9**, 125.

In a study of the "sleepy disease" of the tomato, which is due to *V. albo-atrum*, it is shown that the cotton plant can also act as a host for the fungus. Young plants of *G. herbaceum* were much stunted and the leaves withered without wilting.
—J. C. W.

South African Cotton Insects. G. C. Haines. Experiment Sta. Rec. (from Union S. Africa Dept. Agr. Jl., 1921, **3**, 425-430), 1922, **46**, 656.

A brief summary of the more important insects attacking cotton in South Africa.
—J. C. W.

Cotton Plants; A Preliminary Study on the Mineral Nutrition of Young——. R. B. Espino. Experiment Sta. Rec. (from Philippine Agr., 1920, **8**, 335-343), 1922, **46**, 629.

This study has been undertaken with a view to the profitable conversion of vast areas of non-productive "cogon soil" in the Philippines. The soil can be best improved by the addition of large quantities of calcium nitrate. —J. C. W.

Cotton Culture in Argentina. C. D. Girola. Experiment Sta. Rec. (from An. Soc. Rural Argentina, 1921, **55**, 391-403), 1922, 46, 635.

Some notes on cotton culture in the Republic and details of a cotton-growing contest conducted in 1919-1920 are given. The principal varieties grown in Argentina are Chaco, Texas Wood, Dixon, Simpkins, and Russell. Where grown on a field scale, yields ranged from 641 to 1,869 lbs. per acre and the lint graded about good middling. —J. C. W.

Cotton Supplies; The Future of——. See This *Jl.* (Proc.), 1922, **13**, 143.

American Cotton: Interior Oil Damage. See This *Jl.* (Proc.), 1922, **13**, 143.

(D)—ARTIFICIAL.

Viscose; Preparation of——. S. P. Schotz. Chem. Age, 1922, **6**, 790-792.

In an article dealing with the industrial applications of the Plauson colloid mill, it is stated that, in the manufacture of viscose, if cellulose is mixed with the theoretical quantity of aqueous caustic soda and ground in the colloid mill until a colloidal solution is obtained, it easily forms a mono-sodium derivative which readily reacts with carbon disulphide to form sodium-cellulose-xanthate. It is thus possible to effect the reaction at ordinary temperature by the use of not more than the theoretical quantity of caustic soda, and the formation of injurious thio-compounds is avoided. Other advantages are also claimed for the process. —J. C. W.

Artificial Silk Industry; Progress in the—. E. Bronnert. Jl. Soc. Dyers and Col., 1922, **38**, 153-162.

A general account of progress in the artificial silk industry, with particular reference to a few very important industrial improvements. Photomicrographs of cross sections of different varieties of artificial silk are reproduced. —J. C. W.

Dyeing Cellulose Acetate Silk. See Section 4T.

PATENTS.

Process of Preparing Permanent and Spinnable Solution in the Cuprammonia Process. P. H. Minck, Petersdorf, Germany (Assr. to Chemical Foundation Cor., Delaware, U.S.A.). U.S.P. 1,421,707, 4/7/22; Appl. 23/7/18.

Refers to the process of preparing spinnable cupric-ammonia-cellulose solutions, consisting in the solution and dehydration of the cellulose by means of sugars of the grape sugar group and the hydration of the cellulose by sugars of the cane sugar group, the amount of such sugars being not less than one quarter of 1% and not more than 2½% based on the weight of cellulose employed. —A.

Dextrin; Artificial Filaments; Viscose, etc. Courtaulds, Ltd., London, and W. H. Stokes, Coventry. E.P.181,197 and 181,198, 15/6/22.

Refer to solutions of starch and starchy materials in sulphuric acid which may be used for the preparation of or as an addition to the setting-bath used in the manufacture of filaments, etc., from viscose. —A.

Artificial Filaments: Viscose. Glanzfaden Akt.-Ges., Riesengebirge, Germany. E.P.181,330 (Addn. to E.P.135,205); Conv., 10/6/21.

In the manufacture of a material resembling wool from viscose solutions according to the process described in the parent specification, ripening of the viscose is as far as possible avoided, for example, by conducting the necessary operations of solution, filtration, etc., at temperatures between 0 and 10°C. A.

Fiberizing and Felting Cereal Straw. J. K. Toles, San Francisco. U.S.P.1,420,162, 20/6/22; Appl., 8/7/19.

Apparatus providing means for separating the gumming substances from the fibre of the straw, for crushing and breaking the fibres into relatively short lengths, for felting the fibres into a sheet, and for drying. —A.

Cellulose-ester Products; Method of Preparing——. U.S.P.1,421,290. See Section 4.

2.—CONVERSION OF FIBRES INTO FINISHED YARNS.

(A)—PREPARATORY PROCESSES.

Scutcher: Control. W. Mühlen. Leipziger Monatsch. Text. Ind., 1922, **37**, 109-110.

The author describes precautions which should be taken to avoid sticking of the scutcher rollers and consequent difficulties in the later processes. —J. C. W.

Dust in the Textile Industry: Removal of Dust in Flax, Hemp and Cotton Spinning. Textilberichte, 1922, **3**, 247-248.

In continuation of the previous article (This *Jl.* Abs., 1922, **13**, 138) installations for removing dust caused by carding, drawing and roving operations are described. —L. I. R. A.

Comber Brush; Mounting of——. C. Verstraete. L'Ind. Text., 1922, **38**, 215.

A device is described by which the rapid wear of circular brushes by contact with the grooved segments of cotton combs and the wear of the groovings by friction can be avoided. The circular brushes are attached to oscillating levers controlled by springs and subject to the action of a cam mounted on the shaft of the combs. By this means, the brushes are drawn aside slightly when passing the grooved segments of the comb. This elimination of friction also results in considerable saving of motive power. —J. C. W.

Textile Machinery; Maintenance of——. E. H. Marble. Reprint Amer. Soc. Mech. Engineers, May 8-11, 1922, 17-18.

Common faults in the installation and up-keep of textile machinery are discussed and suggestions made. The purpose of ball bearings is indicated and a warning issued against their ill-considered adoption. The importance of proper lubrication is strongly emphasised. —J. C. W.

Moving Picture: Application. Text. World, 1922, **61**, 3330-3375.

The application and value of the moving-picture camera to cotton research has been demonstrated by the preparation and exhibition of a film showing the effect of moisture on the manufacture of cotton. The film, of which a synopsis is given, demonstrates conclusively the need for proper humidification in the cotton industry and the use of "close-ups," and the slow-speed projector proves the correctness of certain theories while casting doubt upon others. For example, it is possible to see that on the roving frame, dry, statically-charged bunches of cotton hair actually leave the roving before entering the flyer and jump over the twizzle, causing a slack and uneven product. Similarly, when a sliver is broken on a testing machine, it can be shown that the hairs have very slight resistance to separation when dry, but cling together when moist and exhibit a pronounced recoil at the moment of parting. —J. C. W.

Carding Engine. F. E. Banfield, Jun. Reprint Amer. Soc. Mech. Engineers, May 8-11, 1922, 3-7.

The development of the modern revolving flat card is described and an account is given of the machine-shop practice in its manufacture. —J. C. W.

Roller Drafting. F. Hill. Text. Rec., 1922, **40**, 51.

The effect of (1) class of cotton, (2) regularity of staple, (3) nature of the fibres, whether harsh or soft and pliable, (4) counts of yarn produced, (5) class of yarn, whether carded or combed, and (6) number of machines available in determining the correct drafts throughout the mill is discussed. —J. C. W.

Carding Engine. L. J. Mills. Text. Rec., 1922, **40**, 43-44.

Practical notes on cotton spinning processes. This instalment deals generally with the process of carding and with the causes of faulty carding. —J. C. W.

Card Clothing; Manufacture of——. W. R. Hewson. Jl. Man. Coll. Tech. Text. Soc., 1922, **12**, 26-35.

The author describes the development of the modern carding engine, the construction of cotton card foundation cloths, the manufacture of the card wire, and the making and grinding of the cards. —J. C. W.

(B)—SPINNING AND DOUBLING.

Doubling Frame. W. Bailey. Jl. Man. Coll. Tech. Text. Soc., 1922, **12**, 56-64.

A general account of the development of the doubling industry and of the different types of doubling frames employed. —J. C. W.

"Ring Mule." Text. Mfr., 1922, **48**, 183-184.

The inventors claim that by means of this new frame ring spinning of yarns of practically any fineness can be successfully accomplished on the bare spindle. The frame is substantially like the ordinary ring frame, but the yarn is spirally rotated during spinning around the spindle, and twisting takes place at the tip of the spindle as in the mule. The usual thread guides and separators or anti-ballooning devices are dispensed with altogether, and a new type of ring and traveller is used. —J. C. W.

Ring Frame. H. D. Martin. Canadian Text. Jl., 1922, **39**, 227-228.

The author states that fine weft yarn, up to 100's, can now be spun successfully on ring frames, and gives a general account of the precautions to be observed in spinning the finer counts. —J. C. W.

Spinning Frame; Driving——. Text. Mfr., 1922, **48**, 184-186.

The application of rope driving for spinning frames and the advantages of this type of drive are discussed. Tachograph diagrams show that the rope drive is capable of reducing the fluctuations transmitted from the lineshaft, whereas an average belt drive increases the cyclic variations of the driver. —J. C. W.

Wood Fibre Yarns and Fabrics. See This *Jl.* (Proc.), 1922, **13**, 133.

Cotton Supplies; The Future of——. See This *Jl.* (Proc.), 1922, **13**, 143.

(D)—YARNS AND CORDS

Wood Fibre Yarns and Fabrics. See This *Jl.* (Proc.), 1922, **13**, 133.

Yarn Defects. See Section 6.

PATENTS.

Preparing Fibres for Spinning: Process and Apparatus. G. C. Lawrency and M. Vigier, London. U.S.P.1,422,581, 11/7/22; Appl., 26/5/21.

The process consists of the removal of the fibres from the carding engine cylinder in a series of separate tufts, carding and combing a portion of the tufts during removal, retaining the tufts by sectional combs whilst carrying them away from the card, ironing the tufts under application of heat and friction, and removing the fibres from the carrying means by friction whilst their forward ends are combed, seizing the forward ends to enable the rear ends to be combed, and joining the combed fleeces together so as to form a continuous wide sheet. —A.

Preparing Fibres for Spinning: Openers, Cleaners, etc. T. and F. Hilton, Hammersmith, London. E.P.180,060, 18/5/22.

In a machine for carding or dressing, or opening or cleaning flocks, wool, kapok, hair, etc., the fibre is fed forward to the spiked drum by an endless apron comprising a number of endless helical springs arranged side by side. The drum comprises end disks connected by longitudinal rods. The teeth are of resilient metal and provided with a hook to engage an adjacent rod. The action of the drum tends to tighten the coil round the rod. The drum rotates in a casing provided with internal spikes, which may be inclined in the direction of rotation of the drum. —A.

Preparing Fibres for Spinning: Drawing Frames. F. Barlow, Hyde, and F. Helm, Hadfield. E.P.180,063, 19/5/22.

The sliver is passed from the last pair of drawing rollers to the coiler trumpet through one or more pairs of grooved or serrated rods or plates—adjustable so as to exercise a slight compression on the fibres. —A.

Carding Engines. J. P. Huchshorn, Enschede, Holland. E.P.180,178, 25/5/22.

The travelling flats are withdrawn at one or more points from operative contact with the main cylinder and are stripped by suction. —A.

Preparing Fibres for Spinning: Openers, Cleaners, etc. W. Youlten, Hove, Sussex. E.P.180,351, 23/5/22.

A fibre opening and cleaning machine comprising an elliptical chamber surrounded by a rectangular casing. The material is fed into the chamber through a duct, and is treated therein by one or more rotary beaters. The chamber is provided on one side with a grid through which dirt, etc., escapes, and with a discharge valve. —A.

Making Feather Yarns. K. Ohashi, Tokyo. E.P.180,502, 1/6/22.

A machine for severing feathers from the quills, the severed barb parts of the feathers being caught between pairs of rollers and between pairs of threads from spools, the free ends of the pairs of threads being secured to bobbins mounted on a carriage. The bobbins are ultimately rotated to wind the yarn. —A.

Spinning: Rollers and Roller Guides; Roving Guides; Sliver Conductors; Twisting Tubes; Spindle Apparatus. W. Binns and J. D. Mander, Bingley. E.P. 180,712, 29/5/22.

Relates to spinning, drawing, slubbing, roving and like machines wherein fibre is conducted by an air stream as described in Spec. 172,343. —A.

Winding Yarns. Wildt and Co. and E. Wildt, Leicester. E.P.181,155, 15/6/22.

In winding machines of the vertical spindle type for winding yarn upon bobbins or spools with conical bases wherein the guide is mounted on a reciprocating bar and is advanced by a disk rotated on a screwed rod by contact with the yarn, the plate which carries the screwed rod is mounted on a pivot and provided with a bowl so that the thread-guide traverses in a path parallel to the cone of the bobbin. —A.

Spinning: Mules. A. Teale, Yeadon, nr. Leeds. E.P.181,226, 15/6/22.

The tin-roller cylinders are secured to their shaft by a clutch comprising a central tube on a squared part of the shaft and end disks with projections and bevelled edges. The cylinder ends are dished to fit the disks and provided with holes to accommodate the projections when the cylinders are slid into position. The cylinder bosses are secured by set-screws. —A.

Nitrocellulose Solution; Process of Spinning—. R. Haddon (from Fabrique de Soie Artificielle de Tubize). E.P. 157,220, 9/3/22.

The coagulation of the fibre of alcohol-ether solution of nitrocellulose is performed in a bath containing 30-65% sulphuric acid and the thread is wound on bobbins sprinkled with the acid. The product after washing and drying has a high lustre. Solvents and acid are recovered by distillation. The process applies also to other solvents. —F. G. P.

3.—CONVERSION OF YARNS INTO FABRICS.

(B)—SIZING.

Size; Application of——. S. Taylor. Jl. Man. Coll. Tech. Text. Soc., 1922, **12**, 8-25.

An illustrated general paper on tape sizing and hot-air drying, comprising an account of the purpose of sizing and the chief ingredients used, the storage and mixing rooms, the fermentation and steeping of wheat flour, the mixing becks and tapers' boil becks, the tape sizing machine, back beam creels, the cylinder drying chamber, the revolving swift air drying chamber, the headstock, the wraithe and the friction. —J. C. W.

Millet Flour; Composition of——. G. Quagliariello. Physiol. Abstr. (from Atti com. scient. aliment. di Acc. Lincei, 1921, reprint), 1922, **7**, 183.

Millet flour contains a good deal of fat and cellulose, but a relatively small amount of proteins. —J. C. W.

(C)—WEAVING.

Textile Fabric: Specification. Text. World, 1922, **62**, 229.

Proposed revised tentative specifications of American Society for Testing Materials for imperfections and tolerances for 60-inch 17¼ oz. square woven builder fabric made of yarn not less than 8-ply are recorded. —J. C. W.

Reversible Fabric; Manufacture of——. L'Ind. Text., 1922, **38**, 219.

An arrangement is described by which two warp threads are crossed in the usual manner, but between them is a thread held in a stationary heald. Two sheds are thus formed. Two shuttles, one above the other, are simultaneously shot across the loom. By this means the production of the loom is increased and materials of an inferior quality can be introduced into the fabric without injuring its appearance. —J. C. W.

Fessmann-Haemmerle Creel. Text. World, 1922, **61**, 3377.

This is described as a mechanical automatic warping creel. It has the usual V-shape, but the yarn is warped from bobbins or cops without spooling. The bobbins are set in the creel in an upright position and in groups of three, and the creel supply is rendered continuous by tying the ends of the bobbins together and replacing each bobbin as it becomes empty. For this purpose the spindles can be pulled down into a horizontal position. An arrangement is provided for evenly tensioning and clearing the yarn. —J. C. W.

Loom. L. B. Jenckes. Reprint Amer. Soc. Mech. Engineers, May 8-11, 1922, 8-16.

An illustrated account is given of the mechanism of eleven different types of looms used for weaving various kinds of plain and pile fabrics. The functions of the let-off, lay, shedding motion, picking motion, take-up, box-motion mechanism and automatic stopping devices are described. —J. C. W.

Jacquard Harness Improvement. Text. Rec., 1922, **40**, 60-61.

An illustrated description of an improved Jacquard harness, in which the bottom resting bar hooks of the odd rows are turned to the left and those of the even rows to the right. The existing resting grid is modified and the harness cords altered. The advantages of this type of harness are discussed. —J. C. W.

Pneumatic Loom. J. C. Brooks. Text. World, 1922, **61**, 3525.

A loom on which the shuttle and picking motion are replaced by compressed air is illustrated. Nozzles or tubes are placed on the loom and connected with an air supply. A weft inlet is made on the top of the tube three or four inches from the end, and a measuring device is supplied which consists of a sprocket chain. On the sprocket chain are two weft engagers or pullers. The weft passes through suitable guides so that the pullers can engage it and draw off enough yarn to make a double pick. Cams on the sprocket wheel then engage the puller and tip it so as to allow the weft to escape. The yarn is then blown through the warp. The loom can be run at 200 picks per minute. —J. C. W.

Halliwell Yarn Conditioner. See Section 4E.

(D)—KNITTING

Looping Machine; Improvement of——. Text. World, 1922, **61**, 3179.

The following labour-saving attachments are described:—(1) The Paramount chain cutter and stripper. The chain cutter automatically severs the chain connecting looped stockings and the stripping device automatically removes the stockings after they have been sewn. (2) The bell attachment: this instantly announces a broken looping thread. (3) The foot-stop motion with adjustable arm. The foot-stop motion enables the operatives to work without interruption, and the adjustable arm catches the stockings after they have been removed by the stripper and facilitates handling by the operative. The installation of these attachments is stated to increase production, reduce the number of "seconds," and save thread. The attachments are covered by U.S. patents 1,118,589, 1,205,107, 1,205,108, and 1,321,481. —J. C. W.

Knitting Machine: Electric Driving. L'Ind. Text., 1922, **38**, 219-220.

An electric drive for knitting machines is described by which the speed of the main driving shaft can be varied at any instant. —J. C. W.

(G)—FABRICS.

Wood Fibre Yarns and Fabrics. See This *Jl.* (Proc.), 1922, **13**, 133.

Homespuns; Construction, Dyeing and Finishing of——. See Section 4G.

Reversible Fabric; Manufacture of——. See Section 3C.

PATENTS.

Knitting Machine. H. T. Ballard, Norristown, Pa. U.S.P.1,423,175, 18/7/22; Appl., 22/1/20.

In combination, in a circular rib machine, a dial wing cam and means for adjusting the same to make a plurality of groups of courses, each made up of alternate sections of tuck and plain rib with the changes beginning on different wales on the successive courses, and for making groups of courses all of one stitch between the courses of alternate tuck and plain rib, and beginning and ending the sections of alternate knitting on different wales in the successive group courses to produce diamond-shaped spots staggered vertically in one row from those of the adjacent rows. —A.

Knitting Machines: Yarn Control. W. P. Drumheller, Springfield, Mass., Assr. to Wm. Carter Co. U.S.P.1,420,530, 20/6/22; Appl., 10/4/20.

Provides means for effecting change in the rate of positive feed of the yarn. —A.

Weftless Cloth: Method and Apparatus. J. A. McLane, Morgantown, W. Va. U.S.P., 1,420,271, 20/6/22; Appl., 30/3/21.

The process is described as comprising the drawing of a plurality of flexible strands in sheet formation through a bath of adhesive elastic material, maintaining the strands separated by substantial distances whereby the adhesive material will form a web there between, and drying the adhesive material to form the finished product with a substantial thickness of the elastic material between. —A.

Loom; Tubular Fabric——. E. G. Loomis, Newark, N.J. U.S.P.1,423,619, 25/7/22; Appl., 23/7/21.

Tension fingers co-operate with the wrap threads, and a pivoted bearing is provided for each finger and locking mechanism for locking a finger out of operative position. —A.

Looms: Loose-reed Motions. H. Hacking, F. Ashworth, and W. Taylor, Darwen and Haslingden. E.P.179,363, 11/5/22.
The duck-bill and heater are dispensed with, and a bowl on an arm on the stop-rod is adapted to travel over another bowl so arranged as normally to offer a yielding resistance to the bowl which automatically becomes positive to hold the reed fast at the beat-up, but presents no material resistance to the movement of the reed when the shuttle is trapped in the shed. —A.

Leno or Cross-Weaving Looms. F. J. Norris, Fall River, Mass. (Assr. to Draper Cor., Hopedale). U.S.P. 1,416,410, 16/5/22; Appl., 3/11/21.
Provides for combination of two doup heddles, each having an eye for a doup thread, two ground heddles each controlling a single ground thread, a floating eye through which both doup threads pass and means for operating one of the doup heddles and one of the ground heddles as a pair and the other doup heddle and other ground heddle as another pair to form the shed with the ground thread successively placed in the same shed plane and for crossing the floating eye and both doup threads first to one and then the other side of the ground thread. —A.

Rubberised Fabrics. E. Hopkinson, New York, U.S.A. E.P.178,811; Conv., 22/4/21.
Thread is impregnated with rubber latex or "similar material" and a sheet formed by drying a layer of parallel threads. The sheet may be united on one side to a sheet of sateen or the like and on the other to a sheet of rubber. The threads or cords pass in parallel formation from a creel through a rubber and water emulsion bath, between doctor blades, and over drying rolls. A sheet of sateen passes round the rolls under the threads so that during the passage the threads are united to one another and to the fabric. The product may be vulcanised. —A.

Looms. E. Lambert and others, Paris. E.P.178,821; Conv., 4/10/21.
In looms wherein two shuttle-holder arms are caused to move towards and from each other and the shuttle is transferred from one arm to the other when these meet at centre of shed, the shuttle-holders are provided with electro-magnets so as to clutch and release the shuttle at the required times. —A.

Knitting Machines. M. Zwicky, Wyomissing, Pa., Assr. to Textile Machine Works Co. U.S.P.1,417,289, 23/5/22; Appl., 17/10/19.
Loop-regulating mechanism for full-fashioned machine. —A.

Looms: Loose-reed Motion. W. Pemberton and W. R. Thompson, Burnley. E.P. 178,890, 24/4/22.
In a lay-cap, lateral adjustment of which is effected by connecting it to brackets adjustably mounted on the upper ends of the lay-swords—vertical adjustment being provided for by vertical slots in the brackets—the brackets are formed with lateral slots for the reception of bolts or screws which pass through holes in the lay-swords and clamp the brackets thereto. —A.

Embroidering Machines. G. Sieber, Plauen, Germany. U.S.P.1,416,894, 23/5/22; Appl., 10/9/21.
Device for driving the scallop mechanism and auxiliary implements. Cams are arranged axially with the main shaft and a speed-reducing mechanism provides for transmitting motion to the cams at a speed different from that of the main shaft.—A.

Circular Weaving Machine. C. J. Feuerstein, Zwolle, Netherlands. U.S.P. 1,416,344, 16/5/22; Appl., 26/5/22.
Comprises periodically reciprocated drawing bars, heddles reciprocated by the bars and adapted to guide the warp threads, clutches arranged between the heddles and drawing rods for connecting them, and electro-magnetic means for operating the clutches. —A.

Knitting Machine. P. H. Fryer, Philadelphia, Pa. U.S.P.1,416,186, 16/5/22; Appl., 29/6/20.
A machine with needle cylinder, thread guide for feeding a body thread to the needles, thread guide for feeding a splicing thread and means for putting the guides into and out of action. A main thread clamp and cutter, for holding the thread ends and severing the threads between the clamp and fabric on the needles, is combined with an auxiliary clamp within the needle cylinder to provide additional clamping action upon the splicing thread. The auxiliary clamp is out of alignment with the body thread and its guide, whereby an additional clamping of the splicing thread may be had to prevent it from becoming released from the main clamp at the time the splicing thread is fed to the needles and before it is knitted into the fabric. —A.

4.—CHEMICAL AND OTHER PROCESSES.

(B)—Scouring and Degumming

Cotton Fabric: Scouring. F. J. Wall. Text. Colorist, 1922, 44, 372-373.
A general discussion on kier boiling, including notes on loading, volume of liquor used and its circulation, rinsing, inspection, water softening, and the use of kier assistants, such as soap, or soluble or sulphonated oils. —J. C. W.

Oakite; Application of——. F. J. Wall. Text. Colorist, 1922, **44**, 372-373.

Oakite is a kier assistant in dry powder form. It is claimed for it that it can break up and lift from the goods foreign substances which caustic soda will not touch. In combination with the caustic soda, it makes a more penetrating liquor, and dry spots in the kier are very rare when Oakite is used. By the introduction of ½% of Oakite and a reduction in the quantity of caustic soda ordinarily used, an improved finish of the goods is obtained. This reduction in caustic soda reduces the quantity of unused caustic left in the goods after completion of the boil, and the goods are more easily washed out. Being practically free of alkalinity, a milder chemic will suffice to produce a good clear white. A weaker sour can also be used. The final result is whiter goods, having also a better appearance and feel. —J. C. W.

(D)—MILLING.

Homespuns; Construction, Dyeing and Finishing of——. See Section 4G.

(E)—DRYING AND CONDITIONING.

Halliwell Yarn Conditioner. Text. Merc., 1922, **66**, 611.

The apparatus consists of an air-tight chamber from which the air is extracted to form a partial vacuum. Moisture is supplied to the air by means of an atomised spray of water, and it is then returned to the top of the apparatus, whence it passes through the yarn to the bottom. A rapid circulation of the air is thus created. The capacity of the apparatus is such that 18 ordinary doffing skips can be conditioned simultaneously and a high quality mule yarn, counts 100's, gained 6% in 20 minutes. —J. C. W.

(G)—BLEACHING.

Homespuns; Construction, Dyeing and Finishing of——. G. E. Templeton. Amer. Dyestuff Reporter, 1922, **10**, 401.

Medium grade wool, 1,000 to 1,200 ends warp and 16 to 20 picks, plain weaves predominating, is used for factory made homespuns. The wool is dyed fast bright colours and blended with bleached white wool. For bleaching, well scoured wool is immersed in a solution of 3½ to 4½ ozs. potassium permanganate in 10 galls. water for 30—45 min., drained and immersed in a fresh bath of 3½—4 oz. bisulphite (64°Tw.) and 4 to 6 oz. concentrated sulphuric acid per 10 galls. water, worked for 1—1½ hrs. until the brown stain is removed, rinsed and extracted. Bleached wool makes the effect more lively and is considered important. The cloth should be constructed so as not to require milling for more than 1 hr. and should shrink in both directions. The cloth is milled and scoured in soap, and after washing off neutralised with 1% sulphuric acid in the washer. The cloth should be tentered and cut fairly close on both sides until the weave shows and the threads appear plain and round, pressed with cold cylinder and hot bed with light pressure and should not show any gloss. —H. R. H.

(I)—DYEING.

Wool; The After-Chroming of——. A. Claflin. Amer, Dyestuff Reporter, 1922, **10**, 397.

Chromium salts have been investigated for their use as mordants for wool in the afterchrome process and compared with bichromates. Chromium acetate, chloride, fluoride, nitrate, oxalate and sulphate were added to dye baths, after boiling for half-an-hour with the addition of sulphuric acid. The shade of the "acid" dyed material is less changed with these salts than with bichrome. Generally, these salts improve the fastness of the dye itself, but not so completely as bichrome; chromium fluoride gives the best results, and in many cases chromium nitrate acts similarly. —H. R. H.

Padder Dyeing Machine; Control of——. J. M. Kaeppler. Text. World, 1922, **61**, 3789-3793.

Faults in the use of the padder and the causes of unsatisfactory results are described, and an account is given of how the best results can be obtained in padder dyeing cotton goods. —J. C. W.

Tannin; Application of——. J. Steelman. Text. Colorist, 1922, **44**, 451-454.

A general account of the use of tannic acid in the mordanting of cotton and linen. Some experiments are described which indicate the best conditions for the absorption of tannic acid. —J. C. W.

Mucic Acid. Chem. and Met. Eng., 1922, **26**, 1118.

Mucic acid is now being produced on a commercial scale in Montana by the hydrolysis and oxidation of mixtures of glucose and galactose obtained from the Western larch. It is sold as "Cream of milk sugar," and the pure product is used almost entirely in self-raising flours and baking powders, whilst cruder forms have been applied as a substitute for cream of tartar in dyeing. —J. C. W.

Aniline Black; Application of——. L'Ind. Text., 1922, **38**, 230-231.

Some general observations on the dyeing of cotton and mercerised cotton with aniline blacks. —J. C. W.

Dyeing. J. Rouffin. L'Ind. Text., 1922, 38, 226-228.

A mathematical treatment of the factors governing conditions in dyeing, including the speed of circulation of the dye liquor and the absorption of the colour by the fibre. —J. C. W.

Dye: Topping. G. Emmons. Text. Colorist, 1922, 44, 376-378.

A general account of the objects and practice of topping, including the correcting of redness in blacks, improving shades of sulphur dyes with basic dyes, etc. —J. C. W.

Dyeing Cellulose Acetate Silk. W. E. Sanderson. Jl. Soc. Dyers and Col., 1922, 38, 162-165.

A general account is given of the dyeing of cellulose acetate silk:—(1) By saponification and dyeing with direct cotton dyes; (2) with basic dyes; (3) with azo dyes; (4) with azoic dyes; (5) by the production, on the fibre, of insoluble azo colours; (6) by the dry dyeing methods. —J. C. W.

Homespuns; Construction, Dyeing and Finishing of——. See Section 4G.

Light Fastness of Dyestuffs; The Determination of——. See Section 6.

(K)—FINISHING.

Homespuns; Construction, Dyeing and Finishing of——. See Section 4G.

PATENTS.

Treatment of Cellulose Acetate Products to Increase their Affinity for Dyestuffs. British Cellulose Co. and L. G. Richardson. E.P.175,485 and 175,486, 23/2/22.

Saponification of lower than triacetate is controlled more readily if the saponifying bath contains less than 5% of alkali salts of strong mineral or other acid, such as sodium chloride, sulphate and acetate, which control saponification. Easily dissociated alkali salts such as silicates, aluminates, borates may be used to saponify before or concurrently with dyeing. —F. G. P.

Cellulose-ester Products; Method of Preparing. H. S. Mork, Brookline, and C. F. Coffin, Jnr., Watertown, Mass. (Assrs. to Lustron Co.). U.S.P.1,421,290, 27/6/22; Appl., 12/3/21.

In a method of preparing artificial silks of standardised dyeing speed, the steps comprise preparing several batches of silk and subjecting batches of slower dyeing speed to an after-treatment to effect substantial equalisation of the dyeing speeds of the several batches. —A.

Drying Fabrics; Recovering Solvent. Dunlop Rubber Co., Ltd., London (Lewis and Green, Newton, Mass., U.S.A.). E.P.181,100, 6/6/22.

Apparatus for recovery of volatile solvent from fabric, etc., by the process described in Spec. 152,374 wherein cleaned flue gas is passed over the fabric. —A.

Recovering Fats from Waste Waters. Soc. Anon. des Etablissements Balsan, Paris. E.P.180,669; Conv., 27/5/21.

Wool-washing water, or other water containing fat, is subjected to centrifugal treatment, for example in an extractor having a "solid" drum, for the purpose of separating heavier impurities previous to recovery of fat by usual methods. —A.

Bleaching. C. Bochter, Gunzburg, Germany. E.P.180,325; Conv., 16/5/22.

To bleach linen in the spun or woven state, the materials are, without previous treatment with alkalies, treated several times in succession with dilute bisulphite solutions, with intermediate scouring with acid and washing, and are then treated with oxidising bleaching liquids. The operations may be conducted at such temperatures that boiling is avoided. —A.

Cloth; Moth-Proofing——. Farbenfabr. F. Bayer and Co. G.P.347,849. Chem. Zentr., 1922, ii, 1228.

The numerous Bayer patents for the protection of wool, fur, or hair against moths (cf. "Eulan") consist in steeping the goods in solutions of complex inorganic acids, such as hydrosilicofluoric, phosphotungstic, titanofluoric, or hydrofluoric acid. The bath also contains substances which promote penetration, such as sodium chloride or sulphate, or sulphuric or formic acid, or salts of metals which form insoluble salts with the complex acids, such as aluminium, chromium, calcium, tin, zinc, or antimony salts. For example, wool is steeped overnight in a bath containing 1% of titanofluoric acid, 2% of zinc sulphate, 10% of sodium sulphate, and 3% of formic acid, calculated on the weight of wool, and then rinsed and dried. —J. C. W.

5.—LAUNDERING AND DRY-CLEANING.

Continuous Clarification in Dry Cleaning. Dyer and Calico Printer, 1922, 48, 38.

The American dry cleaning industry is said to be awakening to the possibilities of the continuous clarification process. The plant, which is described, consists of a washing machine, a clarifier, a pump, a master trap, a benzine indicator, and the piping and fittings necessary to connect the several parts of the system. —L. M. S.

PATENTS.

Cloth Renovator. Max Wagner. G.P. 350,804. Chem. Zentr., 1922, ii, 1175.

A mixture for removing stains, dirt and gloss from clothes and fabrics, and imparting a freshness, consists of vegetable gum (6 parts), gelatin (9) or starch (14), sodium carbonate (50) or bicarbonate (70), and ammonium chloride (10). The ingredients are dried and finely powdered before mixing, and applied in the form of a solution in a little water. —J. C. W.

6.—ANALYSIS, TESTING, GRADING, AND DEFECTS.

Flavone; Detection of——. G. Klein. Bot. Centr. (from Anz. Akad. d. Wiss. Wien, Math.-Nat. Kl., 1922, **59**, 25-26), 1922, **143**, 236.

Small pieces of tissue containing flavone are treated with a halogen acid, preferably hydrochloric acid, under a sublimation ring at 40°C., and the flavones obtained in a crystalline form. The method can also be applied to dried specimens and to drugs. The different flavones can then be identified by typical reactions as, *e.g.*, colouring with ferric chloride, barium hydroxide and lead acetate. —J. C. W.

Living Cell: Permeability. W. Stiles. New Phytologist, 1922, **21**, 140-162.

In this continuation of his article on permeability (This *Jl.* Abs., 1922, **13**, 152) the author puts forward evidence in favour of the existence of plasma-membranes and discusses their composition and thickness. —J. C. W.

Temperature Regulation: New Automatic Valve. Text. Merc., 1922, **66**, 550.

An automatic valve, consisting of a cast iron steam valve controlled by an expanding pleated copper tube filled with a non-volatile liquid, has been constructed for controlling automatically the steam supply to steam-heated liquids. The valve is immersed in the liquid in a vertical position just behind the main cock of the steam pipe. As the temperature rises the copper tube expands and raises a cap until when the required temperature is reached this cap comes into contact with a spindle and closes the valve. A slight fall in temperature causes the copper tube to contract just sufficiently to maintain the temperature. —J. C. W.

Spectroscope. F. Löwe. Chem. Zeit., 1922, **46**, 465-467.

A short review of the application of spectroscopy in the laboratory and in works, and of the principal instruments in use. —J. C. W.

Spectrophotometer. H. E. Ives. Science Abs. (from Jl. Optical Soc. of America, 1921, 5, 469-478), 1922, 25A, 315.

The author considers that the unique specification of a colour is by means of spectrophotometric analysis, and describes an apparatus for simplifying spectrophotometric measurements. The method consists in measuring adjacent patches of the spectrum, each patch varying in width inversely as the hue perception at that point and being narrow enough to prevent sensible change of colour. The apparatus utilises the principle of the Maxwell colour-box, special slits with movable jaws being provided to facilitate the selection of adjacent spectrum patches. A diagram showing the method of plotting the results pictorially is presented. Ideal conditions would mean about 250 patches, but for the vast majority of colours fewer would answer. The apparatus can also be used for reproducing any colour by opening the slits wide and inserting a sector disc so cut that the radial opening corresponding to each wave-length has the prescribed length. —J. C. W.

Spectrometer. Chem. Age, 1922, **6**, 766.

A new type of spectrometer is described which is designed for use either as a wave-length spectrometer, a monochromatic illuminator for the visible or ultra-violet, or an infra red instrument. The light entering the slit is reflected by a small right angled prism on to a concave mirror. This directs a parallel beam of light on to a dispersing prism mounted on a rotating table. The light is reflected back on to the concave mirror, and is finally brought to a focus at the exit slit. The instrument is adaptable for different investigations by using prisms of glass, quartz and rock-salt. Generally the mirror is of polished silver on glass, but for investigations in the ultra-violet this is replaced by a quartz mirror backed with mercury tin foil amalgam. The advantages of this type of instrument are indicated. —J. C. W.

Short Tube Viscometer: Calibration. W. N. Bond. Proc. Phys. Soc., 1922, **34**, 139-144.

An investigation of the corrections applicable to the determination of the viscosity of liquids by flow through tubes, due to the abnormal flow at the ends. General expressions for the end-corrections are obtained by the method of dimensions. These are employed in plotting the results obtained from experiments on the flow of mixtures of glycerol and water through pairs of tubes of the same diameter but of different lengths. The conditions that the flow at the ends may be purely viscous and the value of the end-correction in this case are obtained by experiment. Equations are given enabling viscosity to be measured by experiments on the flow through orifices or short tubes. —J. C. W.

Solubility Apparatus. M. L. Dundon and W. E. Henderson. Jl. Amer. Chem. Soc., 1922, **44,** 1196-1203.

A method of determining solubilities by the use of floating equilibrium is described. The method is shown to be capable of considerable speed or great accuracy and a reasonable amount of both, and is illustrated in the determination of the solubility of lead acetate between 0° and 50°.
—J. C. W.

Pröttmeter. Deuts. Faserstoffe, 1922, **4,** 59.

The readings of the Pröttmeter represent the ratios between the quantity of water contained in 1 cubic metre of air and the quantities contained in the same volume of air completely saturated at constant heat content, rather than at the same temperature, as is the case with ordinary instruments. It is claimed that this instrument reflects the conditions actually existing in the air. An example is given illustrating the difference between the data of the Pröttmeter and of the hygrometer, polymeter and psychrometer. —J. C. W.

Colloid Mill: Driving. B. Block. Chem. Abstr. (from Chem. App., 1922, **9,** 29-31, 42-43), 1922, **16,** 1519.

Leather belts are not suitable for belt speeds above 25-30 m. per sec. or 3,000 r.p.m. of the pulley with the shafts not less than 4 m. apart. Steel belts are also unsuitable. The high speeds required of the beaters are obtained by toothed gears inserted between the belt-driven pulley or directly connected motor and the beaters. Diagrams are shown in the original of a directly connected steam turbine colloid mill which operates successfully at a speed of 12,000 r.p.m. —J. C. W.

Filtering Viscous Solution. R. F. Jackson and Clara G. Silsbee. Scientific Papers, Bur. of Standards, U.S.A., No.437, 716.

An apparatus is described for filtering viscous solutions under pressure through an asbestos mat. —J. C. W.

Surface Tension of Colloidal Solutions. H. Schleiffer. Kolloid-Zeits., 1922, **30,** 273-278.

Measurements have been made of the surface tension of gamboge, azo-benzene, aluminium hydroxide sol, myristic acid, mastic, and gum arabic solutions at different temperatures. The surface tension of the dispersion medium is lowered by azobenzene, myristic acid, mastic and gum arabic solutions and unchanged by gamboge and aluminium hydroxide sols. The temperature coefficients of all the sols investigated are almost identical with that of water. Internal friction and vapour tension showed no change, so that the colloids in this respect can be regarded as solutions of low molecular concentration.
—J. C. W.

Elastic Gel. R. H. Bogue. Jl. Amer. Chem. Soc., 1922, **44,** 1343-1356.

The author reviews several theories of gel structure and restates and amplifies his theory of a catenary or fibrillar structure. The influence of electrolytes, of varying hydrogen-ion concentration, and of the valence of the combining ion upon several of the characteristic properties of gelatin has been found to give additional evidence in support of the theory presented. Data on the mutarotation of gelatin were found to be in accord with the theory. The occlusion theory of Loeb is reviewed, and found not to be out of harmony with the present theory, but rather to explain the distribution of absorbed water and its variation with hydrogen-ion concentration mathematically in terms of the Donnan equilibrium. —J. C. W.

Refractometer. Chem. Age, 1922, **6,** 766.

This instrument, which has been designed for the measurement of very small differences of refractive index between two liquids, is very valuable for the detection of impurities in liquids. The liquids are contained in a glass cell, and are separated by a thin glass plate, the surface of which is approximately in the plane of the axis of the observation telescope of the instrument. The light from the source passes through the liquid of lower refractive index at grazing incidence on the glass plate, thence through the second liquid at a small angle. The position of total reflection is focussed on the cross wires of the telescope, and the position of the liquid cell is ascertained by the screw motion which rotates the supporting table. If the separating plate and end plates of the cell are made of quartz, measurements can be carried into the ultra-violet. —J. C. W.

Plant Cell: Osmosis. L. Lapicque. Compt. rend., 1922, **174,** 1490-1492.

The results of a general study of osmotic equilibrium between the cell and the surrounding medium are reported. The experiments were carried out on marine algæ, and it is stated that the classic doctrine which likens the plant cell to an osmometer does not account for all the facts observed. —J. C. W.

Acid-Proof Varnish. L. McCulloch. Chem. Age (U.S.A.), 1922, **30,** 232.

The addition of a small amount of paraffin or a paraffin-like wax to a varnish which, in itself, is resistant to water, acid fumes and alkalis will render the varnish considerably more resistant. Various other waxes, such as ozokerite, ceresin, petrolatum and halogenated naphthalenes may be employed, together with various solvents such as benzine, turpentine, etc. The addition of the small amount of wax necessary has no appreciable effect on the properties of the varnishes other than to give them a slightly waxy surface or "feel." —J. C. W.

Gelatin Solution: Viscosity. R. H. Bogue. Jl. Amer. Chem. Soc., 1922, **44**, 1313-1322.

Experiments on the viscosity-plasticity relations in gelatin solutions indicate (1) that gelatin in aqueous solution as measured by the MacMichael viscosimeter follows the laws of viscous flow at elevated temperatures, but exhibits the properties of plastic flow at lower temperatures (above the solidification point), and (2) that there is no sharp transition point between the sol and gel forms in protein systems, but that the transition is continuous and reversible over a somewhat indefinite period. The variation in viscosity with time was studied, and it was found that at a given temperature (35°) the change in viscosity with time was dependent upon the hydrogen-ion concentration, the nature of the inorganic ions present and the amount of hydrolysed protein in the system. The significance of the temperature at which there is no change in viscosity with time is discussed. —J. C. W.

Cell Wall: Constituents. B. H. Cranner. Physiol. Abstr. (from Meldinger fra Norges Landbruksheiskole, Kristiana, 1922, **2**, 1-160), 1922, **7**, 202.

Full details are given of a research directed to ascertain the chemical components of the cell wall and protoplasmic layers lining it. The author finds that if living parenchymatous tissues are left in distilled water lipines are given out into the water which presumably come largely from the walls themselves, as they are obtained before the protoplasts lose their turgescence. At 25°C. only water-soluble lipoids are obtained, giving a clear aqueous solution; at 30°C. insoluble lipines are also obtained, rendering the extract opalescent. These substances can be precipitated by lead acetate. Full details are given of their chemical examination. The conclusion is reached that lipines must form important constituents of the normal cell membrane. —J. C. W.

Universal Indicator. F. H. Carr. Analyst, 1922, **47**, 196-197.

A mixture of methyl-red, naphtholphthalein, phenolphthalein, bromothymol-blue or thymolphthalein, and cresol-phthalein or cresol-red exhibits the following range of colours:—*p.H* 3, pale red; 4, red; 5, orange red; 6, orange; 6·5, yellow; 7, greenish yellow; 8, green; 8·5, bluish green; 9, greenish blue; 9·5, blue; 10, violet; 11, reddish violet. —J. C. W.

Nitrogen; Estimation of—. M. Polonovski and C. Vallée. Analyst (from Ann. Chim. Anal., 1921, **3**, 363-366), 1922, **47**, 80.

A criticism of Folin's adaptation of the Kjeldahl method to the analysis of minute quantities of material, and a detailed description of various improvements. —J. C. W.

Platinum Oxide Catalyst. V. Voorhees and R. Adams. Jl. Amer. Chem. Soc., 1922, **44**, 1397-1405.

An oxide of platinum has been prepared by the fusion of chloro-platinic acid with sodium nitrate, and has proved to be an excellent catalyst in the hydrogenation of various types of organic compounds such as phenol, vanillin, ethyl methyl ketone, salicylaldehyde, and nicotinic acid. The speed of reduction with this catalyst is greater than when ordinary platinum black is used. —J. C. W.

Constant Electrodes. P. F. Sharp and F. H. MacDougall. Jl. Amer. Chem. Soc., 1922, **44**, 1193-1196.

A simple method of electrometric titration has been devised. Employing electrodes of lead amalgam and of cadmium amalgam the authors have prepared a series of half-cells which are electromotively equivalent to hydrogen electrodes in contact with solutions in which the hydrogen-ion concentrations are respectively—10^{-4}, $10^{-4 \cdot 7}$, 10^{-5}, 10^{-6}, 10^{-7}, 10^{-8}, 10^{-9}, 10^{-10}. —J. C. W.

Spectrograph. W. F. Mêggers and K. Burns. Sci. Papers Bur. Standards, 1922, **18**, No.441, 189-191.

An instrument whose optical parts consist of quartz and rock salt is described. This spectrograph was designed for photography of interference phenomena in the ultraviolet, but is also serviceable in the visible spectrum and has certain advantages over other types of spectrographs for investigating the shorter waves. —J. C. W.

Stigmatic Concave Grafting Mounting. W. F. Mêggers and K. Burns. Sci. Papers Bur. Standards, 1922, **18**, No.441, 191-196.

The Wadsworth mounting in which the slit is, in effect, placed at infinity with the aid of an auxiliary mirror, thus filling the concave grating with parallel light, gives spectral images which are practically free from astigmatism. The characteristics and performance of such an instrument are outlined, and detailed drawings of the apparatus are reproduced. —J. C. W.

Viscosimeter: Calibration. W. H. Herschel. Chem. and Met. Eng., 1922, **26**, 1175-1177.

An account of the standardisation and calibration of the Saybolt Furol viscosimeter and of the calibration of the Redwood Admiralty type of instrument. Probable equations are derived for these two instruments and for the Saybolt Universal viscosimeter connecting kinematic viscosity expressed in c.g.s. units with the time of flow in seconds. These equations have been used to calculate tables for correlating readings obtained by the three instruments. —J. C. W.

Cadmium Vapour Lamp. F. Bates. Zt. Instrumentenkunde (from Phil. Mag., 1920, **39**, 353-358), 1922, **42**, 90.

After a short summary of the available sources of mono-chromatic light and their respective disadvantages the author proceeds to describe the production of a cadmium-gallium lamp which yields a pure red cadmium line of great brilliancy. The gallium lines which are detectable have so low an intensity as to become negligible. It is claimed that the lamp will last indefinitely. —J. C. W.

Amino Acid; Estimation of——. R. Engeland. Zt. Physiol. Chem., 1922, **120**, 130-140.

To confirm the reliability of a method described by the author some time ago for the analysis of the mono-amino acids derived from proteins, by converting them into the corresponding betaines, the process is applied to gluten, the amino acids of which have been accurately determined by other methods. Details of the method are given. —J. C. W.

Diphenyl-Guanidine; Application of——. C. A. Carlton. Jl. Amer. Chem. Soc., 1922, **44**, 1469-1474.

The use of symmetrical diphenyl-guanidine as a standard in acidimetry and alkalimetry is discussed. The substance is easily obtained in a state of sufficient purity by three recrystallisations of the crude material from toluene. It is stable in the air and readily soluble in alcohol. It can be titrated directly in the cold with either an alcoholic or an aqueous solution of hydrochloric acid, using bromophenol-blue or methyl-red as indicator. The results obtained by its use are comparable with those obtained with sodium carbonate or silver chloride, and the substance is more convenient to use. It is the only basic substance so far proposed that meets all the requirements of an ideal standard. —J. C. W.

Sodium Chloride; Electrolysis of——. G. Quaink. Chem. Zeit., 1922, **65**, 490-491.

An illustrated description of the Siemens-Billiter process for the electrolytic decomposition of alkali chlorides. The principal feature of the apparatus is the horizontal diaphragm consisting of asbestos mats, coated with a thin layer of a barium sulphate and asbestos wool paste, and resting on a false bottom of iron-wire gauze which serves also as the cathode. By this arrangement a complete separation of the anode and cathode products is obtained. Chlorine is led off through the cover of the apparatus, and caustic soda is run off from the floor of the trough. It is stated that this type of diaphragm remains porous and resistant longer than the vertical type, since both sides of it are in contact with alkaline solutions. —J. C. W.

Acetone-Sulphur Dioxide Solution; Application of——. H. Plauson. Chem. Zeit., 1922, **46**, 555.

A solution of sulphur dioxide in acetone is recommended as an organic extraction and absorption medium. It is especially suitable for the selective extraction of solid or liquid mixtures of hydrocarbons and other organic compounds, for the refining of oils, separation of paraffin, ozokerite, etc. —J. C. W.

Calcium and Magnesium; Estimation of—. P. Dutoit and E. Grobet. Jl. Chemie Physique, 1921, **19**, 328-330.

Analyses of mixtures of calcium and magnesium and of barium and calcium show that the sorption of one metallic ion by the precipitate given by the other can be prevented completely if the solution in which precipitation is taking place is mechanically stirred throughout the experiment. —J. C. W.

Rapid Dialyser. A. Gutbier, J. Huber and W. Schieber. Ber., 1922, **55**, 1518-1523.

A new apparatus by means of which large quantities of colloidal solutions can be rapidly and completely freed from electrolytes is described and illustrated. The main features of the apparatus are a stirring arrangement erected concentrically with a glass frame-work which rotates in the opposite direction to the stirrer. The membrane is fixed, bag-like, over the frame and allowed to fall in loose folds. By this means the membrane surface is made as large as possible. This portion of the apparatus fits into a bell-jar through which a continuous stream of fresh water flows, so that the difference in concentration of the electrolyte within and without the membrane is as great as possible. The dialysis can be carried out at any temperature. The results of a comparative investigation of the speed of dialysis in the Graham dialyser, the Zsigmondy-Heyer dialyser, and the rapid dialyser, stationary, running at 50 revolutions per minute and at 100 revolutions per minute are presented. —J. C. W.

Polarised Membrane: Permeability. Li Shou Houa. Annales de Physique, 1922, **17**, 475-503.

It is shown that when an inert membrane separates pure water from a solution of a barium, magnesium, or ammonium salt acidified with a strong acid there is an accumulation of hydrogen-ions in the neighbourhood of the surface in contact with the solution and the membrane is polarised. The polarised membrane then acts as selective filter towards the anions and cations of the solution and a re-arrangement of ionic groups takes place. The biological significance of the results is discussed. —J. C. W.

Spectrum Tube. W. F. Mêggers and K. Burns. Sci. Papers Bur. Standards, 1922, **18**, No.441, 196-199.

Instructions and suggestions are given for the preparation of Plücker tubes commonly required for optical demonstration, testing, or research. The remarks apply especially to tubes containing hydrogen, nitrogen, oxygen, helium, neon and argon.
—J. C. W.

Cadmium Vapour Lamp. W. F. Mêggers and K. Burns. Sci. Papers Bur. Standards, 1922, **18**, No.441, 185-187.

The wave lengths for 13 lines in the spectrum of tubes containing cadmium vapour at low pressure are measured relative to the primary standard by means of the Fabry and Perot êtalon interferometer. The probable error in most of these values is less than 0·001 A.U. Constant frequency differences are established which define the separation of subordinate series limits. Evidence that the wave lengths derived from spectrum tubes are reproducible is presented. —J. C. W.

Chlorine Dioxide; Application of——. E. Schmidt and K. Braunsdorf. Ber., 1922, **55**, 1529-1532.

The behaviour of chlorine dioxide towards amino acids, amines, amides, and their derivatives, imides, polyhydric alcohols, mono- and polybasic acids, oxy-acids and their esters, nitriles, cyclic compounds, phenols, unsaturated carbon compounds and carbon-sulphur compounds has been investigated, and some amino acids and their derivatives, phenols, unsaturated compounds and carbon-sulphur compounds are found to be unstable. The application of chlorine dioxide in histology is discussed. The observation of many animal tissues is made difficult by a brown or black colour due to the presence of melanine which probably arises from tyrosine, 3·4—dihydroxyphenylalanine and tryptophane. These coloured products are unstable towards chlorine dioxide, so that if the tissue is treated with this reagent, preferably in acetic acid solution, it becomes paler without suffering change in structure and can then be easily studied under the microscope. —J. C. W.

Sugars; Detection of——. O. Baudisch and H. J. Deuel. Jl. Amer. Chem. Soc., 1922, **44**, 1585-1587.

It has been found that all the simpler carbohydrates, including the pentoses, decompose on distillation with sodium hydrogen carbonate yielding as one of their products the ketone alcohol, acetol. This is readily identified by heating with *o*-aminobenzaldehyde and potassium hydroxide, when it condenses to form 3-hydroxyquinaldine, which is recognised readily by its intense bluish fluorescence in sodium bicarbonate solution. —J. C. W.

Standard Deviation Calculator. W. Lawrence Balls. Proc. Roy. Soc., 1922, 101A, 333-341.

The paper describes and illustrates another calculating apparatus derived from the harmonic analyser formerly described. The present apparatus mechanically applies the method of least squares to calculating standard deviations of frequency distributions. By suitable modifications of the arrangement used in the harmonic analyser the loaded-string system has been made to give quantitative results over a wide range of amplitudes and weightings. The apparatus is simple and inexpensive to construct, simple and quick in use, and retains its sensitivity and zero indefinitely.
—J. C. W.

Emulsion: Interfacial Tension. H. Hartridge and R. A. Peters. Proc. Roy. Soc., 1922, 101A, 348-367.

A comparison of the capillary height, drop-weight, and a modified ripple method of measuring interfacial tension, shows that the drop-weight method is valid for comparing the interfacial tensions of oils, or fatty acids, against aqueous solutions of varying reactions. Using the drop-weight method the following observations have been made:—(1) The decrease in interfacial tension between fatty substances in benzene solution and aqueous "buffered" solutions depends upon (*a*) the concentration of fatty substance, (*b*) the presence of a small amount of "available" monovalent alkali in the aqueous phase, *i.e.*, alkali not in combination with strong acid, (*c*) the hydrogen-ion concentration at the interface; (2) for a series of pure substances it is found that the changes in interfacial tension produced by changes in reaction of the aqueous phase occur only with the substances which have the carboxyl group, free or in combination, as glyceride. A hypothesis is developed to correlate the above conclusions. —J. C. W.

Animal Charcoal. G. Gustaver. Kolloidchem. Beihefte, 1922, **15**, 185-338.

Adsorption isotherms for water, alcohol and acetic acid vapour at 20°, 25°, 30° and 35° have been determined with animal charcoal as the adsorbing agent.—J. C. W.

Copper - Ethylenediamine Solution. W. Traube. Ber., 1922, **55**, 1899-1912.

A further experimental study of the reactions between copper bases and polyhydroxy-compounds. It is shown that when copper-ethylenediamine hydroxide and glycerol interact free ethylene diamine is formed, subsequent to the formation of copper ethylenediamine-glycerate. A solid compound, described as cupri-ethylenediamine-cupri-glycerate, has also been isolated and analysed. The reactions of cellulose with Schweitzer's reagent and copper bases in general are discussed in the light of these results. —J. C. W.

X-Rays; Application of——. F. Haber. Ber., 1922, **55**, 1717-1733.

The author discusses the conditions affecting the formation of amorphous precipitates and crystalline sols, and the application of Röntgen-ray interference phenomena to distinguish between the amorphous and crystalline states. —J. C. W.

Chlorine; Estimation of——. Stefan V. Bogdándy. Zt. Physiol. Chem., 1922, **120**, 30-39.

The author reviews and classifies the recent methods for the estimation of chlorine in organic materials and justifies experimentally a method which he described in 1913 and which has since been the subject of adverse criticism.—J. C. W.

Thread-Counting Glass; New——. H. Hartinger. Textilberichte, 1922, **3**, 247.

The device consists of a lens stand into which three different lenses, of 6, 8, or 10-fold magnification, can be fitted as required. Counting squares of 1, ½, or ¼ in. sides can be fitted into a ring in the lower part of the stand and can be turned through 90°. The distance between the lens and the counting square can be varied as desired by means of a screw on side of the stand. Each lens consists of a thick bi-convex lens and two thin concave-convex lenses. —J. C. W.

Cellulose: Fermentation. L. Spiegel. Zt. Physiol. Chem., 1922, **120**, 105.

In a research on the formation of fats in plants, the author employs cellulose as raw material and shows that small quantities of fats are formed by the action of an enzyme solution prepared by triturating seed meal (sunflower, etc.) with water. The cellulose was used in the form of an "emulsion" obtained by dissolving filter paper in concentrated sulphuric acid and reprecipitating by a strong jet of water. —J. C. W.

Water: De-aeration. P. West. Jl. Ind. Eng. Chem., 1922, **14**, 601-607.

Commercial processes for the elimination of dissolved oxygen, which is the principal cause of the corrosion of metals by water in an enclosed system, depend on one of two methods. In the *de-oxidising* method the hot water is allowed to pass into a deactivating tank, where it is brought into contact with thin sheets of specially prepared metal, on which the water exerts its corrosive activity. The *de-aerating* process removes the free dissolved gases from the water by heating, by vacuum, or by a combination of both, while the water is sprayed over baffles in a deactivator. The latter process removes nitrogen, carbon dioxide, etc., as well as oxygen.—J. C. W.

Scoured Cotton Fabric: Ash Control. P. Heermann and Sommer. Textilberichte, 1922, **3**, 238.

Cotton fabric bleached by ozone was repeatedly washed in the usual manner at a steam laundry, each "wash" consisting of (1) steeping for half an hour at 30-40°C. in a "permutised" water (2-3° of hardness) with soap and soda; (2) rinsing with the soft water at 40°C.; (3) boiling for half an hour at 85-90°C. with soap, soda and soft water; (4) rinsing with the soft water; (5) a final rinse with fresh water (22° hardness), the two rinsings lasting for 35 minutes. The ash content of the fabric was determined after every ten washings, and was found to rise steadily, 6·72% of ash being obtained after 50 washings. Even greater increases in ash content have been recorded when the washing agent has contained water-glass, 20% and 24·5% of ash being quoted. —J. C. W.

Starch; Composition of——. H. von Euler and K. Myrbäck. Annalen, 1922, **428**, 23-24.

Lintner starch was found to contain 0·17% of —PO_4 by Woy's method, or 0·188% by a micro-method, whilst rice starch, analysed by the micro-method of Svanberg and others (1921) was found to contain 0·306%. —J. C. W.

Fats; Properties of——. E. André. Bull. Soc. Chim., 1922, **31**, 459-525.

An exhaustive review of the present state of knowledge concerning the chemistry of fats, divided into the following chapters:—Tests; separation and identification of fatty acids and glycerides; principal constituents of fats, including saturated and unsaturated acids, hydroxy-acids, alcohols, hydrocarbons, sterols; action of air and light in the "drying" of oils.—J. C. W.

Cellulose: Fermentation. B. Haas. Chem. Zeit., 1922, **46**, 561.

A study of the bacterial decomposition of old books and manuscripts shows that unbleached cellulose is more resistant to attack than bleached cellulose, that soda, wood, and straw celluloses are less resistant than sulphite cellulose, and that soda-wood cellulose is more resistant than soda-straw cellulose. —J. C. W.

Cotton Fibres; Determination of the Different Technological Qualities of——. F. Heim and O. Roehrich. Experiment Sta. Rec. (from Bull. Agence Gen. Colon. France, 1921, **14**, 749-773), 1922, **46**, 635.

Methods are given for determining the length, diameter, maturity, tenacity, and elasticity of cotton fibres, with remarks on the graphic expression of numerical results and on classing cotton. —J. C. W.

Oxycellulose. E. Heuser and F. Stöckigt. Cellulosechemie, 1922, **3**, 61-76.

The furfuraldehyde yield of pure cotton may be as low as 0·5%. Pure cellulose and hydrocellulose yield only oxymethylfurfuraldehyde. Sufficiently oxidised cellulose yields furfuraldehyde, but never methylfurfuraldehyde. Oxymethylfurfuraldehyde is present in small quantities as an impurity. The copper numbers alone cannot be employed to distinguish between oxy- and hydrocellulose. Only those reactions of oxycellulose which depend on the reactivity of the carboxyl group are characteristic. A characteristic property of oxycellulose is the splitting off of carbon dioxide by distillation with dilute hydrochloric acid. Under similar conditions hexoses, cellulose, and hydrocellulose yield no carbon dioxide. A titrimetric method of estimating carbon dioxide is described. By partial hydrolysis with dilute acid under pressure the oxidised portion can be separated from oxycellulose. The residue consists of a hydrolytically decomposed cellulose (hydrocellulose). The carboxylic acid obtained was isolated as the barium salt, but could not be identified on account of its instability. —J. C. W.

Cellulose Solution; Viscosity of——. R. A. Joyner. Jl. Soc. Chem. Ind., 1922, **41**, 276-277R.

The viscosity of cellulose in cuprammonium hydroxide diminishes as the copper content increases up to a certain limit, the concentration of the cellulose and ammonia being kept constant; the viscosity falls as the concentration of ammonia increases, when the concentration of the cellulose and copper remain constant; but the viscosity rises as the concentration of cellulose increases, the concentration of copper and ammonia being kept constant. The action of sodium hydroxide on the viscosity of cellulose was studied at different temperatures with varying concentrations, and on the assumption of the presence of two celluloses of widely different viscosity the reaction appeared to obey the monomolecular law. No degradation products of cellulose were formed when the viscosity was lowered by the addition of N/30 and N/100 sodium chloride solutions at 100°C. A simple relationship was found for the action of air on cellulose dissolved in cuprammonium hydroxide, and the viscosity of the solution was reduced very quickly and without formation of oxycellulose by adding sodium hypochlorite in alkaline solution. —J. C. W.

Testing Cotton Fibres. Text. World, 1922, **62**, 229-231.

Proposed tentative methods of the American Society for Testing Materials relative to the preparation of sample and procedure in the testing of cotton hairs are described. —J. C. W.

Starch "Iodide." H. von Euler and K. Myrbäck. Annalen, 1922, **428**, 1-24.

The authors have studied the partition of iodine between benzene and starch solution. The results indicate that the combination of iodine and starch is not a process of adsorption or formation of a solution of iodine in starch. The step-wise production of two definite compounds was revealed, each stable at a definite iodine dissociation pressure. The blue compounds do not contain hydriodic acid. —J. C. W.

Cellulose; Action of Water on——. F. Kaye. Chem. Zentr. (from India Rubber Jl., 1922, **63**, 535), 1922, iv, 53.

Cellulose, rubber and coal all develop aldehydes when distilled with water (see This *Jl.* Abs., 1922, **13**, 110). This is considered to be an interesting fact in connection with biological relationship of these three substances. —J. C. W.

Steaming Oven. A. G. Perkin. Jl. Soc. Dyers and Colourists, 1922, **38**, 186-187.

A convenient apparatus for demonstrating or studying the development of colour on cotton fabrics by steaming is described. The device consists in directing the steam which issues from a briskly boiling water oven back into the oven itself. For this purpose, a short pipe is fixed into the steam exit, to which is attached a funnel for filling the oven. By means of a tap fixed just below the funnel this exit can be closed and the steam directed into the oven by a branch pipe passing through the ordinary central opening of the oven. A cap fitted to this opening is perforated to allow for the final exit of the steam. To prevent external cooling, the door of the apparatus is provided with an inner jacket filled with asbestos powder. —J. C. W.

Starch Indicator. W. J. Painter. Analyst, 1922, **47**, 166-167.

A stable solution of starch is prepared by boiling common rice starch with about the same weight of sodium carbonate, in water, cooling, acidifying with hydrochloric acid, and leaving for a day in contact with granulated zinc. —J. C. W.

Adsorption. Wolfgang Ostwald and R. de Izaguirre. Kolloid-Zeits., 1922, **30**, 279-306.

A critical discussion of earlier work on adsorption, of various types of adsorption curves, and of adsorption formulæ. A theory is advanced that adsorption consists in the first place in a displacement of equilibrium between the solvent and the solute. Formulæ representing the quantitative relations between adsorption and concentration have been developed. The equations are found to agree well with results previously obtained by other workers. —J. C. W.

Cellulose Acetate; Testing——. M. Entat and E. Vulquin. Analyst (from Ann. Chim. Anal., 1922, **4**, 131-135), 1922, **47**, 312-313.

Cellulose acetates do not usually contain any free sulphuric acid, but this acid has frequently been reported to be present, owing to the fact that sulphoacetates of cellulose are partially hydrolysed by water and so give a precipitate with barium chloride. The only way to test for free sulphuric acid is electrometric titration with barium hydroxide. Details of the method are given. —J. C. W.

Yarn Defects. Goodall. Text. Rec., 1922, **40**, 76-77.

A lecture on defects of yarns as experienced by the bleacher and dyer. These include: (1) Oil stains. (2) Irregular mixings of raw cotton; especially serious in mercerising, and not due to bad gassing as was formerly believed. (3) Dead cotton. (4) Irregular twist; hard places dye up lighter than soft, especially with surface colours. (5) Uneven gassing; partially gassed places become darker. (6) Irregular tension and other mechanical faults in winding cops, cheeses, balls, and bundles. (7) Over-conditioning. The lecturer stated (but this is not reported) that mildew generally produces hydrocellulose, but he had encountered a purple mildew on Italian yarn which gave oxycellulose. —J. C. W.

Buskop Tearing Tester. S. A. van Hoytema. De Textielindustrie, 1922, **3**; Bijblad, Mededeel, Rijksvoorlicht. Vezelhandel, Delft, 35-38.

The essential feature of this tester is a kind of clamp which is attached to a Schopper apparatus. The clamp consists roughly of three pairs of wrought iron pieces placed side by side, with the test piece bolted between the upper and lower sets. The middle pair is attached to the upper jaw of the Schopper tester and the outside pairs to the lower, so that the middle portion of the fabric is shorn out on working the machine. The apparatus has been tested in the Dutch fibre research institution and compared with the ordinary tensile testers. Trustworthy data were obtained by taking an average of 10 observations on the tensile machine and 25 on the new tearing apparatus, but the increased number of tests is not a serious drawback, as the pieces of fabric required are not large and records are quickly made. The pieces may be cut so that the strength in any direction between warp way and weft way may be tested. In the case of similar fabrics of cotton and wool the results of the tensile and tearing tests were quite at variance, the former suggesting that the fabrics were about equally strong, whereas the new test indicated that the woollen material was about twice as strong as the cotton in each case. —J. C. W.

Ultra-Violet Lamp. A. F. Kitching. Analyst, 1922, **47**, 206-207.

Fluorescence excited by ultra-violet light is recommended for test purposes in the textile industry. Cotton may be readily distinguished from wool or silk. Casein fluoresces more strongly than gelatin or cellulose. The presence of as little as 1% of acetone in alcohol may be detected distinctly. A suitable light is obtained from an arc between nichrome or tungsten poles, or a mercury lamp, screened by Chance's ultra-violet glass which transmits light from 4,000-3,000 A.U. —J. C. W.

Testing Yarn Evenness. E. D. Whalen. Text. World (from Builders), 1922, **61**, 3177.

An apparatus is described for testing the evenness of yarn by photographing the irregularities under a very high magnification. The yarn passes from the bobbin between two points, the upper of which supports a small mirror. Irregularities in the yarn cause the mirror to vibrate, and a point of light reflected by the mirror on to sensitive paper produces a zigzag line. It is stated that by applying motor mechanism it will be possible to test a comparatively large amount of yarn at the expense of very little labour.—J. C. W.

Light Fastness of Dyestuffs; The Determination of——. H. S. Busby. Text. Colorist, 1922, **44**, 367-369.

The requirements of a scientific method for determining relative fastness of dyes to light are discussed. Variable factors, such as method and completeness of dyeing, nature of the fibre, etc., must be eliminated. All dyes to be tested should be reduced to a uniformly standardised solution and "absolute fastness" determined by subjecting the solution to a uniform light source. Accurate and detailed information concerning the spectrum of the light source must be obtained. To obtain the relation between absolute fastness and fastness of colours as dyed on a fabric regional concentrations of the dye (bearing a certain mathematical relation to the concentrations of the dye solutions) should be applied to the fabric, which should then be exposed as in the case of the dye solutions. The fastness value of such processes as "afterchroming" could be studied by a similar procedure. —J. C. W.

Platinum Vessels in Analysis. D. Baralew. Chem. Trade Jl. (from Chem. Zeit., 1922, June 27), 1922, **71**, 76.

Baralew found that platinum when strongly heated loses about 0·0006 grams per hour. It has not yet been determined whether this loss in weight is a property of pure platinum or whether it is due to the presence of other metals of the platinum group or to other impurities. The most probable explanation of the phenomenon connects it with the capacity of the platinum to occlude gases from the blow lamp flame. —L. M. S.

Turkey-Red Oil; Estimation of——. Chem. Abstr. (from Collegium, 1921, 279-282), 1922, **16**, 1876.

Practical details are given of the methods adopted by the German Turkey-red oil manufacturers' union for the analysis of Turkey-red and finishing oils. —J. C. W.

Wood Fibre Yarns and Fabrics. See This *Jl.* (Proc.), 1922, **13**, 133.

Wool Fibre Measurement. See This *Jl.* (Trans.), 1922, **13**, 157.

7.—BUILDING AND POWER.

(A)—CONSTRUCTION OF BUILDINGS.

Dust in the Textile Industry: Removal of Dust in Flax, Hemp and Cotton Spinning. See Section 2A.

(B)—FIRE PREVENTION.

Zinc Dust: Fire Extinguishing. S. H. Katz and J. J. Blomfield. Text. Colorist, 1922, **44**, 391-392.

Tests of hand extinguishers on zinc-dust fires indicate that a frothy mixture (the preparation " foamite firefoam " was used) is superior to water, sodium carbonate solution, carbon tetrachloride, and silicon tetrachloride, but danger of re-kindling had passed only after the elapse of several hours, due to retention of heat in the metal by the non-conducting foam blanket.
—J. C. W.

(D)—LUBRICATION.

Kapff Oil-Testing Apparatus. S. Kapff. Textilberichte, 1922, **3**, 245-246.

An apparatus for testing the lubricating power of spindle, crank and cylinder oils is described and illustrated. The oil is tested under circumstances which are more comparable with working conditions than is the case with ordinary viscosity determinations. The test consists essentially in measuring the work required to maintain a spindle at constant revolution when running in the oil under gradually increasing pressure on the bearing surfaces. The revolutions are adjusted for different classes of oil (4,000 for ordinary lubricants, 6,000-7,000 for spindle oils), and the oil well may be heated so as to test the specimen under something like working temperatures —J. C. W.

Viscosity and Friction. W. H. Herschel. Experiment Sta. Rec. (from Jl. Soc. Automotive Engin., 1922, **10**, 31-41), 1922, **46**, 688.

Comment is made on the properties of lubricants, units for viscosity measurement, and absolute viscosity relation to the readings of instruments ordinarily used. Mathematical analyses are presented with reference to data given in tabular and chart form. The estimation of viscosity at one temperature from the observed viscosity at another temperature is treated in a somewhat similar manner, including a discussion on complete film lubrication, journal friction and viscosity. Consideration is given to the transition point, the relation between the different factors at the transition point, and incomplete film lubrication, and the oiliness of lubricating oils. A lengthy discussion is also given of the differences in oiliness of different lubricants as indicated by laboratory and service tests. Ten specific features of oil friction testing machines are enumerated.
—L. M. S.

(F)—LIGHTING.

Sheringham Daylight Lamp. S. H. Groom. Science Abs. (from Illum. Eng., 1921, **14**, 215-218), 1922, **25**, 278.

In the original lamp, light from a gas-filled lamp was directed on to a reflector coated with a pattern in ultramarine and emerald-green with a small addition of vermilion. Recently the substitution of a lighter tint of ultramarine has led to an improvement, practically doubling the efficiency of the unit. The substitution of 5% yellow for 2% vermilion has also led to greater accuracy in the imitation of daylight.
—J. C. W.

Factories; The Lighting of——. Chem. Trade Jl., 1922, **71**, 72.

In the third report of a committee appointed to inquire into the conditions necessary for the adequate and suitable lighting (natural and artificial) of factories and workshops the following recommendations are submitted:—Definite legal minima shall not at present be imposed, but a specification of minimum standards of illumination as " recommended practice " for different groups of processes shall be issued. The schedules A and B given in this report shall be taken as the basis of this specification—the standard of illumination for processes grouped in Schedule A shall not fall below 3 foot-candles, and for processes grouped in Schedule B shall not fall below 5 foot-candles, both schedules and standards being subject to amendment from time to time. These schedules cover " fine " and " very fine " work. No definite recommendations on mixed lighting can be given at present. —L. M. S.

Lamp: Brightness. W. E. Forsythe. Jl. Franklin Inst., 1922, **193**, 251.

The author gives values of the brightness in candles per sq. cm. of nine different types of light sources, the results of measurements made by at least two of the following three methods:—(1) Direct measurement by means of an optical pyrometer having a yellow-green glass as mono-chromatic screen; (2) photometric measurement of candle-power of an area of known size; and (3) measurement of colour temperature and calculation from the known brightness of a black body.
—J. C. W.

8.—DESIGN.

Design: Microscopic Growth Phenomena. H. Schenk. Textilberichte, 1922, **3**, 239.
The conclusion of the author's account of fabric design based on natural growth forms (This *Jl.* Abs., 1922, **13**, 172). Further directions are given for the preparation of microscope slides by the crystallisation of organic acids in the presence of dyestuffs. A method is described by which the preparations may be preserved if they are not to be photographed immediately. —J. C. W.

Repeating Pattern. P. A. MacMahon. Jl. Roy. Soc. Arts, 1922, **70**, 567-582.
A lecture before the Royal Society of Arts giving an extended account of the design of repeating patterns based on geometrical forms. —J. C. W.

9.—COMMERCE, ECONOMICS, LABOUR, ORGANISATION, COSTING, &c.

Rest-Pauses; An Experiment in the Introduction of——. E. Farmer and S. M. Bevington. Jl. Nat. Inst. Ind. Psychology, 1922, **1**, 89.
Despite a reduction of nearly 3% in the hours worked, owing to the interpolation of rest-pauses of seven minutes during the morning and afternoon, the total weekly output of the workers was increased by over 5%. —L. M. S.

A Comparison of Judgments in the Evaluation of Cloths. H. Binns and C. Burt. Jl. Nat. Inst. Ind. Psychology, 1922, **1**, 93-98.
A preliminary inquiry into the questions how far such judgments are self-consistent, how far they differ from individual to individual and from class to class, and by what mental factors they are chiefly influenced. —L. M. S.

Vocational Guidance in Foreign Countries. G. H. Miles. Jl. Nat. Inst. Ind. Psychology, 1922, **1**, 108.
The work of several institutes, including the Academic Prace of Czechoslovakia and the "Psychotechnical" Laboratories in Berlin, where attention is concentrated on a particular industry or branch of industry is outlined. —L. M. S.

Crossbred Wool and B.A.W.R.A. Bd. of Trade Jl., 1922, **109**, 46-47.
A statistical memorandum is given which shows that the stock of crossbred wool in the hands of the B.A.W.R.A. has diminished in the last two years by about 239 million lb., while the stock of wool in Argentina and Uruguay has diminished in the same period by approximately 131 million lb. The supply of crossbred wool in the world has diminished in two years by about 240 million lbs. —L. M. S.

Labour Turnover; An Inquiry into——. Jl. Nat. Inst. Ind. Psychology, 1922, **1**, 103.
The loss in potential output arising from the labour turnover of a certain factory has been calculated. —L. M. S.

British Textiles for Yugo-Slavia. Times Trade Supp., 1922, **10**, 386.
The prospects generally of the trade in British textiles are beginning to show distinct signs of improvement. British cottons have maintained their position in Southern Serbia, in spite of their high prices. Last year Great Britain sent £1,000,000 worth of goods, including cotton tissues, woollen textiles, and cotton yarns and threads, to the Serb-Croat-Slovene Kingdom, but this trade fell off gradually as the year passed, corresponding roughly to the depreciation in the exchange value of the dinar. —L. M. S.

Wool Exports from Chungking, China. U.S. Commerce Reports, 1922, July 3, 21.
Exports from Chungking (from Tibet) declined from 2,870 thousands of pounds in 1919 to 1,716 in 1920 and 578 in 1921, partly owing to lessened demand from U.S.A. Large stocks have accumulated on the Szechwan-Tibetan border.—L. M. S.

B.A.W.R.A.: Stocks and Disposals. Bd. of Trade Jl., 1922, **109**, 102.
Stocks December 31, 1921, and disposals first half 1922. —L. M. S.

10.—MISCELLANEOUS.

Bentonite: Application. S. D. Wells. Paper, 1922, **30**, 7-10.
It has been found that bentonite is a very effective peptizing agent for the removal of printing ink in the manufacture of new paper from old paper. —J. C. W.

Cloth; Disinfecting——. R. Kraus and J. M. de la Barrera. Chem. Abstr. (from Rev. Inst. Bacteriol, 1921, **2**, 49-55), 1922, **16**, 1968.
Experiments with circulating hot air proved it to be more effective than formaldehyde for disinfecting cloth and paper. Formaldehyde only affects the surface of such materials and may cause tendering. —J. C. W.

Standardization of Colours. H. Trillich. Color Trade Jl., 1922, **11**, 14-19.
A continuation of the first article (This *Jl.* Abs., 1922, 13, 156); the Ostwald colour theory is further discussed. —L. M. S.

ABSTRACTS

I.—FIBRES AND THEIR PRODUCTION.

(A)—MINERAL.

Canada: Asbestos. See Section 9.

(B)—ANIMAL.

Wool Growing in the United States: Tariff and Effect on Sheep Breeding. P. T. Cherington. Bull. Nat. Assoc. Wool Mfrs., 1922, **52**, 327-344.

A summary is given of the wool history of the country by sections; there is, in fact, in the U.S. not a single sheep industry, but several so widely different that they cannot be safely discussed together. The economic conditions bearing on sheep raising have undergone a series of changes in recent years, conditions to-day widely differing from those of 60 years ago in every essential particular in practically every type of sheep raising. It is urged that the industry, if restored, should be reconstructed by the application of sound principles of agriculture and not by a tariff duty based on the theoretical operating costs of a diminishing type of sheep raising and applied rigidly to all grades of wool raised under every conceivable sort of condition. Tables are given showing the number of sheep, wool production and wool imports by groups of States, and the wool production from 1840 to 1920; also maps showing the relation between the population centre and the centre of wool production in 1840, 1860, 1890 and 1920, and the wool production and imports of the different States in 1921. —L. M. S.

Karakul Sheep. R. O. Wahl. Experiment Sta. Rec. (from Union S. Africa Dept. Agr. Jl., 1920, **1**, 509-527 and 626-642), 1922, **46**, 766.

Deals with the origin and management of Karakul sheep and their introduction into other countries. A description of the sheep is furnished as to conformation and condition of fleece desired in lambs and in mature sheep, together with a classification of the pelts of the lambs. The results of breeding investigations carried out at the Grootfontein School are also reported. —L. M. S.

Suffolk Sheep. S. R. Sherwood. Experiment Sta. Rec. (from Jl. Min. Agr., 1922, **28**, 880-886), 1922, **46**, 766.

A brief account of the history, description and management of Suffolk sheep. —L. M. S.

Crossing Pure Breeds of Silkworms in Relation to Modern Theories of Hybridisation and Heredity. R. Grandori and G. Bolle. Bull. Agric. Intell. (from Ann. della R. Sta. Bacologica di Padova, 1920, **XI.—XIII.**, pt. 2, and Allevamenti, 1921, **II.**, 107-108), 1921, **12**, 1315-1316.

Grandori, as a result of experiments in silkworm crossing, concludes that Mendelian laws hold good only to a certain extent, but there is some uncertainty as to whether the specimens used are really pure bred. It is concluded that breeding by Mendelian methods alone is not practicable, and a combination of these with methods of selection is advocated. Prof. Bolle has arrived at similar conclusions from results of experiments on white Japanese breeds reared at Gorizia.—W. R.

Silkworms Mounting on Broom. Favero, P. Bull. Agric. Intell. (from Boll. del Consiglio provinciale d'Agric. Trent., 1921, **34**, 189-192), 1921, **12**, 1317.

Refers to a method for obtaining heavier cocoons of greater uniformity of excellence. —W. R.

Results of 1919-1920 Season of Silkworm Egg-Breeding in France. Bull. Agric. Intell. (from Bull. Mens. de l'Office de Renseignments Agric., 1920, **19**, 353), 1921, **12**, 1315.

Results show that the silkworm egg-breeding industry has recovered from its period of economic depression and has now attained its pre-war level, and that the efforts to improve the quality of French silkworm eggs have been successful. —W. R.

Sheep Breeding. R. C. Miller. Experiment Sta. Rec. (from Breeders' Gaz., 1922, **81**, 139-140), 1922, **46**, 766.

An account of the sheep investigations of the U.S. Dept. Agric., including results obtained at Dubois, Idaho, on range sheep investigations, and at Vienna, Va., on investigations of sheep diseases.—L. M. S.

Argentina: Wool Production and Export. See Section 9.

B.A.W.R.A. Wool: Stocks and Disposals. See Section 9.

(C)—VEGETABLE.

Fertilizer Experiments with Müll. O. Heuser. Experiment Sta. Rec. (from Mitt. Ver. Förd. Moorkult. Deut. Reiche, 1921, **39**, 383-385), 1922, **46**, 720.
Experiments with müll, a composted domestic waste, on a well-decomposed lowland moor soil, rich in nitrogen, growing hemp, showed that the müll caused a distinct increase in yield. —L. M. S.

Hemp Cultivation in Damascus. U.S. Commerce Reports, 1922, July 17, 164.
Cannabis sativa is grown in Damascus, the fibre being somewhat shorter than the better grades of Italian hemp and also somewhat coarser; it compares more nearly with certain types of hemp imported from China, which is prepared in such a manner as to leave the fibres coarser and stiffer than the water-retted Italian hemp. About one-half of the total production is exported, principally to Egypt; no hemp sacking is produced in Damascus, as all that is required is imported from India. About 274 metric tons were exported in 1921, and it is estimated that a like quantity was consumed in domestic rope manufacture. —L. M. S.

China: Cotton Production in Chihli Province. U.S. Commerce Reports, 1922, July 17, 163.
The total production of raw cotton in 1921 showed an increase of about 20% over the output in 1920. Cotton of both Chinese and American species is cultivated. Of the Chinese species there are the dark seed and the white seed varieties, and of the American species, the long fibre and golden fibre. In such districts as Chienhsien the soil is especially adapted to the cultivation of American cotton, while in other parts of the province both the Chinese and American species can be grown with equally encouraging results. There is a cotton experiment station at Sankow. The output in this district during 1921 amounted to 17,333,333⅓ lbs. —L. M. S.

Peruvian Cotton: Cultivation. Times Trade Supp., 1922, **10**, 526.
The cotton production of Peru for 1919 was 33,558 metric tons. The varieties grown are:—Peruvian cotton (*Gossypium Peruvianum*); *Gossypium Herbaceum*, known as "Upland" in the U.S. and as "Egyptian" in Peru; Sea Island and Mitafifi; "Chanchamayo," a spontaneous growth of the Montana region; and another variety, the result of the researches of Mr. Tanguis. Peru's average yield is 484lb. per acre, against 309lb. per acre for U.S., 390lb. for Egypt and 370lb. for India. —L. M. S.

Cotton Supply; The World's——. Cotton, 1922, **28**, No.1340, 14.
A compilation of the world's cotton production, by the National City Bank of New York; gives the percentage of the world's cotton crops supplied by the United States from 1800 to 1921. —L. M. S.

Industries of the Island of Gozo. Jl. Roy. Soc. Arts, 1922, **70**, 662.
The Island of Gozo, of the Maltese group, has an area of 20 sq. miles, most of which is devoted to agriculture, cotton being grown during 1920-21. The lace-making industry of the island has been on the decline for the last five years and up to the present time, owing to the scarcity of demand in foreign markets. —L. M. S.

Egyptian Cotton Pest. Times Trade Supp., 1922, **10**, 407.
The official figures show that about 1,465,135 acres are under cotton this year, as against 1,289,805 last year. The normal area has been 1,690,928 acres, and the largest area was 1,827,868 acres in 1920. In middle Egypt and in the southern part of lower Egypt the ravages of the cotton worm have been, so to speak, insignificant, but in the northern part of the Delta, particularly Behera and the Dakahlia, the damage is reported to be considerable. —L. M. S.

Cotton Seed Sterilization and Pink Bollworm: Report of Cotton States Entomologists. Jl. Econ. Ent., 1922, **15**, 110-111.
Describes discussions on pink bollworm scouting and on cotton dusting in the cotton States of the U.S.A. —W. R.

Short Flax; Breaking and Scutching——. Spinner u. Weber, 1922, No.20, 1, 3.
Retted, short flax treated in an Etrich machine gives a good strong yarn up to 25's (metric). Since little tow is produced the results compare favourably with those given by long flax which yields a large proportion of tow. —L. I. R. A.

Calcium for Higher Green Plants; The Significance of——. R. H. True. Science, N.S., 1922, **55**, 1-6.
Seedlings were grown in solutions of calcium and magnesium salts. At concentration up to 900×10^{-6}gm. per litre there was no evidence of injury from calcium, but in stronger solutions magnesium caused injury and death. Calcium ions render other nutrient ions physiologically available to the plant. The rôle of calcium in the cell-wall is discussed. Some light is thrown on the practical problem of the value of lime in soils, and these observations on cell physiology suggest one way, perhaps of many, in which higher green plants find calcium necessary.—L. I. R. A.

Cotton-Seed Mixing Increased by Modern Gin Equipment. W. W. Ballard and C. B. Doyle. U.S. Dept. Agric., Circular No.205, 1922.

It is shown that cotton seed mixing has been considerably increased by modern ginning equipment. Suggestions are made by which superior varieties may be maintained. It is stated that the most effective method of avoiding seed mixture is through the organisation of one-variety communities. —J. C. W.

Cotton Cultivation in the French Colonies. F. Koechlin. Bull. Soc. Ind. Mulhouse, 1922, **88**, 84-100.

A report of the committee of the Paris section of the Société Industrielle de Mulhouse appointed to consider the question of cotton cultivation in the French colonies and the advisability of establishing an Institute of Colonial Agriculture. It is stated that cotton could be successfully produced in many of the colonies, but especially in West Africa and Cambodia and the colonies in Senegal and the Sudan, but scientific control is indispensable. A brief survey of the different organisations existing in France shows that none of these is suitable for the proposed scheme. Suggestions are therefore put forward for the immediate formation of a special organisation which shall serve as a scientific and administrative headquarters for the control of cotton growing in the colonies. Reference is made to the work of the Empire Cotton Growing Committee in England and to the work of certain agricultural colleges in Belgium and Holland. —J. C. W.

Indian Cotton; A Preliminary Study of the Demand for Various Types of——. B. C. Burt. Indian Central Cotton Committee, Pamphlet, 1922.

A summary of such information as it has been possible to collect with regard to the trade demand for various types of Indian cottons and the trend of the changes which are believed to be taking place. It is shown that roughly 50% of the yarn spun in India is of counts of 20's and over, for which the cotton grown in India is little more than sufficient. The production of such yarns tends to increase, and therefore the suggestion is made that growers should aim at supplying more of the suitable raw material rather than be content with minor improvements. —J. C. W.

Cotton Thrips. H. W. Bedford. Wellcome Tropical Research Laboratories, Bull. No.18, 1921.

A full description of the life history and habits of the cotton thrips in the Sudan. The nature and extent of injury caused by the thrips is indicated, and preventive and remedial control measures are recommended. —J. C. W.

Flax Pulling Machinery. Text. Merc. (Reuter's Trade Service), 1922, **68**, 113.

In the recent mechanical flax-pulling competition organised by the Société Centrale d'Agriculture de la Seine-Inférieure at Vattetot-sous-Beaumont, near Bolbec, three machines took part in the tests. The jury awarded 3,000 francs to the firm of Messrs. Marshall and Sons, of Gainsborough; 3,000 francs to M. Zémont, a manufacturing engineer at Doullens, who entered a new type of puller with vertically drawing belts; and 3,000 francs to the Push-Tombyl pulling and binding machine constructed at Sorau and exhibited by the Russian engineer, Schneider. Before leaving the field the members of the jury suggested various improvements which they considered might with advantage still be introduced in the machines. —L. I. R. A.

Flax; Contribution to the Selection of—— by Pure Lines in Hungary. R. Fleischmann. Z. f. Pflanzenzuchtung, 1921, **7**, 26-43.

Selection of flax has been carried out at Debro in Hungary since 1919. The first selection was for length of stalk, and a gain of 10 cm. in the first year was noted. Many intermediate types between the long-stalked and short-stalked varieties were noted. Some very interesting correlations between the lengths of the offspring and the lengths of the parents were obtained, and in all cases these correlations were high. The author is amplifying his research in the direction of number of seeds per capsule, shape dimensions and colour of seeds. The work has reference entirely to external characters.

—L. I. R. A.

Boll Weevil Control. J. E. Cross. Text. World, 1922, **62**, 565.

A device consists of an apparatus by which a beam of light is thrown a thousand yards across a cotton field. Weevils and moths attracted to the source of the light are sucked through upright tubes, by an exhaust fan, into a trap which is carried between the wheels on which the machine runs. The inventor claims to have trapped from 10 to 15 bushels of weevils in one night. —J. C. W.

Ramie Industry in China. Jl. Roy. Soc. Arts, 1922, **70**, 629.

Ramie (*Boehmeria nivea*) is extremely durable, being one of the strongest and finest fibres known. It is slightly lacking in elasticity, but is less affected by moisture than any other fibre. It takes dye readily, and the fibres have a brilliant, silky lustre. In Japan it is prepared to resemble silk thread, and is used for the making of artificial silk garments.

—J. C. W.

Cotton Cultivation: Mississippi. H. B. Brown. Experiment Sta. Rec. (from Mississippi Sta. Circ., 1921, No.37), 1922, **46**, 532.

The importation of large quantities of cotton seed into Mississippi for planting purposes leads to the suggestion that home-grown seed could have been purchased for half the cost and with a large saving of transportation expense. In variety tests at the college station in 1920 Mississippi-grown seed averaged 951 lbs. of seed cotton per acre, whilst seed grown outside the State produced 817 lbs. Omitting the improved station strains, the averages still left a difference of 36 lbs. in favour of the Mississippi-grown seed. In each of three years plants from home-grown King cotton have yielded slightly more than plants from North Carolina-grown seed of the same strain.—J. C. W.

Cotton "Asal." H. W. Bedford. Wellcome Tropical Research Laboratories, Bull No.17, 1921.

The *asal* (or sticky substances) found on the cotton plant in the Sudan is either produced by the plant itself owing to its unhealthy condition, or is due to the secretions or excretions of certain insects which feed on the plant. Both forms may be present simultaneously. Of the three types of insect asal, the "honey-dew" produced by the cotton aphis is the most common, and can be identified by the presence of numerous colonies of these insects on the under side of the leaves. The asal of white flies is somewhat similar in nature, but can be recognised by the presence of large numbers of the mealy white-winged flies, and their scale-like larvæ and pupæ, on the under-surface of the leaves. The cotton thrips causes a very different type of asal, which is dry in nature and is due to the excreta of the larvæ of this insect; the latter are deposited as a sticky dark speck on the leaf. Asal produced by the two former species of insects is frequently over-grown by a sooty fungus which lives on it, and gives the leaves a dirty black appearance.
—J. C. W.

Cotton; An Improved Type of—for the Dharwar-American Tract. G. L. Kottur. Agric. Jl. India, 1922, **17**, 347-352.

The correlation existing between leaf hairiness and resistance to red leaf blight in Dharwar-American cotton was studied and an improved strain known as Gadag I. was developed. This strain resists red leaf blight to a remarkable extent, bears big bolls and yields better. It has also a higher ginning percentage. Spinning tests with Gadag I. cotton show that the staple is more uniform in length and better in strength. —J. C. W.

Fibre Plants; Domestic——. G. Sellergreen. Experiment Sta. Rec. (from K. Landtbr. Akad. Handl. och Tidskr., 1921, **60**, 388-424), 1922, **46**, 532.

This article, one of a series on the fibre plants of Sweden, reviews the history of fibre plant production in Europe; treats of the morphology of the stem and the fibre cells of the plant; discusses the influence of soil type and fertilizer treatment on the growth of the plant and the value of the product, as based on results previously noted; compares different methods of retting; enumerates the various qualities that characterise good flax; describes several Swedish installations for the preparation of the flax fibre, and points out the need for standardising and grading the fibre for market purposes.
—L. I. R. A.

Cotton Plant Disease. Experiment Sta. Rec. (from S. Carolina Sta. Rpt., 1921, 17-22), 1922, **46**, 741.

Notes are given on studies of cotton anthracnose, angular leaf spot, a new cotton disease, and on a plant disease survey carried out by the S. Carolina experiment station. From experiments conducted in the case of anthracnose, to determine the effect on the fungus of seed treatments and methods of storing the seeds, it appears that different methods of drying the seed did not reduce infection to any marked extent. Field studies of selections indicated that certain strains of varieties commonly infected with anthracnose were free from disease. On the control of angular leaf spot, former conclusions have been confirmed. As a result of these investigations the station recommends the delinting of cotton seed with sulphuric acid as a means not only for the control of angular leaf spot, but also for reducing anthracnose infection and hastening the germination of the seed. A cotton disease causing a constriction of the stalk and death of the plant at the surface of the soil has been investigated and several fungi isolated, one of which seems to be capable of producing the disease on healthy cotton plants. —J. C. W.

Pyrethrum Extract as an Insecticide. E. N. Cory. Jl. Econ. Ent., 1921, **14**, 345-347.

The alcoholic extract of pyrethrum when prepared in the form of a heavy liquid soap mixes readily with water in any desired proportion, spreads evenly and sticks fairly well. The work reported, in which a number of different insects were used, indicates that it has a decided effect as a contact insecticide, and is also considerably repellant, and possibly toxic. The field for the use of this material in greenhouses, on flowers and ornamental plants, and in home gardens seems to be promising. —J. C. W.

Esthonian Phosphorite and its Effect on Different Plants. M. Wrangell. Die Landwirtschaft. Versuchs Sta., 1920, **96**, 1-44.

Experiments are reported with various mineral phosphates, including two qualities of an Obolus Apollinis sandstone from Esthonia. Flax was used in some of the series. The flax was found to be not very susceptible to a phosphatic fertiliser, and it is believed that this plant is more affected by the acid reaction of the soil than by the alkaline reaction or by lime. —L. I. R. A.

Solid Culture Media; Preparation of——. F. A. Wolf and I. V. Shunk. Experiment Sta. Rec. (from N. Carolina Sta. Tech. Bull., 1921, No.20), 1922, **46**, 740.

Agar or gelatin media, if cooled before being made acid or alkaline, will jellify at limits far beyond H-ion concentrations tolerated by micro-organisms. The media may then be manipulated so as to avoid contamination during the adjustment of the reaction and need not be subsequently sterilised. —J. C. W.

Cotton Pest: Control. Experiment Sta. Record (from S. Carolina Sta. Rpt., 1921), 1922, **46**, 747.

In the study of the life history and habits of the cotton-root aphis, the manner in which ants transfer the aphids to the roots of certain winter food plants, such as "life-everlasting" or "rabbit-tobacco," was worked out. The results of these observations of the seasonal food plants are reported in diagrammatic form. Applying these studies to farm practice, it was found that a successful winter cover crop eliminated the winter food plants from the cotton fields and greatly delayed spring recolonisation, which, supplemented by frequent early shallow cultivation, reduced the losses from this pest to insignificance. Investigations of temperature and moisture in relation to insect activity indicate that successful hibernation depends on the ability of the insect to lose a certain percentage of its body weight, ranging from 26 to 33%. In hibernation studies of the boll weevil, 12% of a total of 10,000 weevils placed in cages emerged in the spring of 1921, or the largest percentage known to pass the winter successfully. This was due to the unusually mild winter. —J. C. W.

Linen Industry in France; Reorganisation of the——. See Section 9.

A Study of Flax and Kindred Fibres. See This *Jl.* (Trans.), 1922, **13**, 161.

Scientific and Industrial Research in Canada. See This *Jl.* (Proc.), 1922, **13**, 156.

Mechanical Flax-Pulling Tests. See This *Jl.* (Proc.), 1922, **13**, 155.

Irish Flax Crop: The Continental Harvest. See This *Jl.* (Proc.), 1922, **13**, 156.

Cotton Growing Facilities in the Sudan. See This *Jl.* (Proc.), 1922, **13**, 154.

(D)—ARTIFICIAL.

Artificial Silk Waste; Use for——. Fibre and Fabric, 1922, **75**, 29.

A new use for artificial silk waste, previously employed to some extent for mixing with wool to impart finish, has been found by Herr W. Rexroth, of Germany. The new Rexroth process involves the breaking up of the waste, chemically treating it to resist water, spinning it on the worsted system, and then weaving it into cloth. The process is said to give a fabric which can be washed and boiled with soap, without harm. —L. M. S.

Artificial Silk and its Applications in the Textile Industry. See This *Jl.* (Proc.), 1922, **13**, 145.

PATENTS

Viscose; Preparation of——. R. Linkmeyer. G.P.337,672. Deuts. Faserstoffe, 1922, **4**, 65.

A process is described in which crude brown cellulose is used instead of bleached cellulose in the manufacture of cellulose xanthate. There is no advantage in using bleached cellulose, as the threads prepared from it by the viscose process are always yellow or brown in colour. The breaking strength and lustre of the fibres increases with increasing cellulose content of the solution. Thus fibres having a higher breaking strength and a higher lustre are obtained from a 12-15% viscose solution than from a 7% solution. —J. C. W.

Artificial Filaments; Films; Viscose. Courtaulds, Ltd., and M. T. Callimachi, London. E.P.181,900; and Courtaulds and H. J. Hegan, Coventry, E.P.181,901.

(1) A solution of starch (containing 5% of moisture or less) or starchy matter in a large quantity of strong sulphuric acid, and consisting of products intermediate between starch and glucose, is used in the manufacture of filaments, films, etc., from viscose as described in Spec. 21405/07. (2) A small quantity of a substance such as sodium oleate, which lowers the surface tension of the viscose solution relative to the setting bath, is added to the former. This prevents unevenness of the resulting thread. —T. L.

Lustrous Threads (Artificial Silk); Process for Producing——. C. A. Huttinger, Assr. to Acme Art. Silk Co., Cleveland, Ohio. U.S.P.1,425,654, 15/8/22; Appl., 12/6/19.

Wood pulp is saturated with a solution of sodium hydroxide and water of a sp. gr. of substantially 1·17. The mixture is subjected to pressure and carbon bisulphide added to the resultant alkali cellulose. The next stages embrace the adding of water, filtering, and then forcing the resultant viscose solution through suitable dies into a precipitating bath comprised of a semi-neutral sulphate salt and water, the said bath containing no free acid and being used at, substantially, 70°F. —A.

Wool-like Threads from Cellulose Materials. P. H. Minck, Petersdorf, Germany (to Chemical Foundation Co., Delaware, U.S.A.). U.S.P.1,428,246, 5/9/22; Appl., 16/5/19.

This process comprises treating cellulose with a solution of caustic alkali sufficient to produce incomplete hydration without an excess of water, at a temperature of not over 20°C., transforming the cellulose into xanthogenate by carbon bisulphide, dissolving the xanthogenate in an aqueous solution of caustic alkali of 3—5% and spinning the solution in a mineral acid bath. —A.

Process for the Extraction of the Cellulose from Vegetable Fibres. Beniamino Cataldi, Turin. U.S.P.1,424,620, 1/8/22; Appl. 17/5/21.

This is by treatment with chlorine gas, heat, pressure, steam and alkalis.—T. L.

Boll Weevil Catcher. William Stanalan, Garrison, Texas. U.S.P.1,424,265, 1/8/22; Appl. 19/10/20.

Refers to a device in combination with a cultivator. —A.

2.—CONVERSION OF FIBRES INTO FINISHED YARNS.

(A)—Preparatory Processes.

Saco-Lowell Vertical Opener and Cleaner. R. C. Curley. Text. World, 1922, **62**, 321-325, and Cotton, U.S.A., 1922, **86**, 693-694.

An illustrated description of the machine, which is equipped with ball bearings and a new type of adjustable grid which has considerably increased its cleaning efficiency. The results of numerous tests emphasise the advantages of triple and tandem installations. —J. C. W.

Changing the Preparing According to the Number to be Spun. Gerjac. La France Text., 1922, 418.

The question as to how much preparing machinery is required in a mill depends on the number of the yarn to be spun. When a certain system of preparing is producing for a definite number with its determined amount of twist, a number x of rove bobbins feed a number Y of ring bobbins. If the number of yarn is changed this proportion is immediately destroyed. A number of formulæ are given so that for any number to be spun the right speeds can immediately be worked out. A change in number is made either without changing the "hank" roving which feeds the spinning, or by changing the preparing conditions; standard formulæ are given for either case. —A. H. M.

Automatic Card Sliver Evener. Text. World, 1922, **62**, 327.

The Reilly automatic card sliver evener can be applied to all standard makes of cards. It practically eliminates waste, and insures the proper weight of sliver from the second yard taken from the card after stripping. Some of the advantages of the Reilly device as observed in the subsequent processes of yarn manufacture are described. —J. C. W.

(B)—Spinning and Doubling.

Yarn: Variations in Twist. H. D. Martin. Cotton, U.S.A., 1922, **86**, 713-715.

The causes contributing to variation of twist in yarns are enumerated. Among the serious causes often overlooked the author emphasises the effect of waste-bound spindles and the effect of the decreasing size of the spindle whorls as the result of wear. —J. C. W.

Spinning Half-Linen Yarn. J. M. Chailow and S. S. Drosdow. Chem. Zentr. (from Ber. Polytechnikum Iwanowo Wosniessensk., 1922, **6**, 219-220), 1922, iv, 269.

The authors have mixed crude flax and cotton in different proportions and have ascertained that these proportions remain constant in the half-linen thread spun from the mixtures. —J. C. W.

Some Physical Quantities of Mule Yarns. See This *Jl.* (Trans.), 1922, **13**, 172.

(C)—Subsequent Processes.

Lindsay-Hyde Winder. Text. World, 1922, **62**, 327.

In this improved winder, the use of friction cups to accomplish the building up of the yarn on the bobbin is eliminated. The builder motion employs a very sensitive trigger, which releases instantly when the yarn breaks. The builder is automatic, combining a tension device, lubricating device and a positive knot catcher that cannot be tampered with by the operative. The machine winds from skeins, cones, or tubes. —J. C. W.

(D)—YARNS AND CORDS.

Spinning Half-Linen Yarn. See Section 2B.

Some Physical Quantities of Mule Yarns. See This *Jl.* (Trans.), 1922, **13**, 172.

A Study of Flax and Kindred Fibres. See This *Jl.* (Trans.), 1922, **13**, 161.

PATENTS.

Preparing Fibres for Spinning: Feeding Carding Machines, etc. J. W. Walker, Batley. E.P.181,960, 29/6/22.

The weighing apparatus of an automatic hopper feeder is driven from the feed lattice of the carding engine through a clutch arrangement, so that the feed lattice can be reversed without any disengagement of parts connected with the automatic feeder. —T. L.

Spinning (Artificial Silk). Siemens-Schuckertwerke, Siemensstadt, near Berlin. E.P.181,694; Conv. 13/6/21.

In centrifugal apparatus for spinning artificial silk and viscose, oscillation of the vessel in which the threads are spun and wound is prevented. —T. L.

Artificial Silk, etc. W. P. Dreaper, London. E.P.181,758, 19/6/22.

Strands of artificial silk are so operated upon that, during the final drying process, the individual filaments forming the strand are kept in continuous relative movement, whereby they are prevented from sticking together, and they assume a more or less crinkled appearance, thus increasing the covering power of the finished product. —T. L.

Preparing Fibres for Spinning: Feeding Openers, etc. J. C. Chadwick, E. Holt and F. Chadwick, of Rochdale. E.P. 181,548, 22/6/22.

The fleece passing from one unit to another of a breaking-up or other machine is passed into a transverse chamber where it collects and from which it is removed by means which seize a section of the fleece and positively invert it, so that it is fed forward with the less worked face upwards. —T. L.

Combing Machines. J. Hetherington and Sons, Ltd., Manchester, and J. Horridge, Bolton. E.P.181,970, 29/6/22.

An arrangement in which a fan or aspirator, driven from the loose pulley on the driving shaft, is employed to remove the waste from the cylinder brushes. —T. L.

Lubricating Spinning Spindles. D. K. Marsden, Stalybridge. E.P.181,561, 22/6/22.

When means whereby an oil tube is inserted within the spindle bolster are employed, an annular recess is provided around the lower end of the oil tube to retain any overflow of oil. —T. L.

Spinning: Mules; Stop-motions. W. Percival, Oldham. E.P.181,479, 14/6/22.

A device, including a spring-loaded detector, for preventing the belt from being shifted back on to the fast pulley when the rim band begins to fray or unravel.—T. L.

Winding Yarns: Winding Machines. T. A. Boyd, H. A. Boyd, and J. and T. Boyd, Ltd., Shettleston Iron Works, near Glasgow. E.P.181,785, 12/6/22.

In cop or pirn winding machines, the feeler which is moved by the yarn to effect the building of the cop is rotated by frictional contact with the stem of the pirn or paper tube by means of a frictional driver or disk. —T. L.

Apparatus for Card-grinding. Lejeune. F.P.524,865; Appl., 12/9/20.

Comprises a shaft screwed on the same width as the main cylinder or doffer, an apparatus for grinding provided with two segments having female screws gearing alternately on the screws of the driving shaft, and a rod fixed to the steps of the brackets bearing the driving shaft and provided with two movable rods with hooks for breaking up the rods which bear the emery-cloths. —Bur. Text.

Yarn Reclaiming Device. A. R. Breen, Chicago (Assr. to Universal Winding Co.). U.S.P.1,427,056, 22/8/22; Appln., 4/11/21.

A device for unravelling yarn or thread from articles of fabric. —A.

Spinning Machine. E. E. Bradley (to Atwood Machine Co., Stonington, Conn., U.S.A.). U.S.P.1,425,363, 8/8/22; Appln., 25/1/19.

Provides for individual electric motor driven spindles, means coacting with the spindles for self-balancing them, and electric motor driven feed rolls, the motors for the spindles and feed rolls being synchronised. —A.

Spinning: Mules. Soc. Alsacienne de Constructions Mecaniques, Mulhouse, France. E.P.182,815; Conv., 9/7/21.
Provides for the driving of the rollers at two different speeds during the outward run—a low speed at commencement. —A.

Winding Yarns. A. Smith, G. Hattersley and Sons, Ltd., and G. W. Shackleton, Keighley. E.P.182,979, 20/7/22.
Refers to mechanism in a thread guiding and tensioning device for a Universal winding machine. —A.

Spinning: Drawing Mechanism. A. C. Butler, Manchester. E.P.182,507, 5/7/22.
A cap or plate is fitted over the intermediate bottom roll and by its own weight presses the sliver against the roll. Specifications 10205/88, 13952/89, and 136,146 are referred to. —A.

Artificial Silk. H. Dreyfus, London. E.P. 182,166, 21/6/22.
In manufacture from solutions of cellulose acetate, nitro-cellulose, or other ester, ether, or derivative of cellulose by a dry-spinning process, the spinning solution is composed of the cellulose ester, etc., and a mixture of one or more low boiling point solvents or liquids and a solvent or solvents of high boiling point, and the filaments or threads are drawn out during spinning, the high boiling point solvent retarding solidification and facilitating drawing out. Larger jet orifices may be employed for producing a given denier. —A.

Stranding Threads, etc. J. Piquet, Sotteville-les-Rouen, France. E.P. 182,502, 30/6/22.
Relates to machines for twisting and stranding twisted or untwisted threads—machines of the kind in which a number of bobbins are rotated by frictional contact of pulleys thereon with a ring—and consists in driving the ring at variable speeds in either direction. —A.

Preparing Fibrous Material for Spinning: Feeding Carding Engines, etc. J. W. Walker, Batley. E.P.183,021, 20/7/22.
In an automatic hopper feeder having a spiked lattice delivering material into a scale which empties on to an horizontal lattice, etc., the weighing box is carried by weighted arms fulcrumed on knife edges. The arrangement is controlled by a cam plate or equivalent device driven from the horizontal delivery lattice, the feed rollers of the carding engine, or other suitable part. —A.

Lubricant. E.P.179,344. See Section 7.

3.—CONVERSION OF YARNS INTO FABRICS.

(B)—SIZING.

China Clay; Testing——. See Section 6.

Potato Starch: Variations. See Section 6.

Starches; Detection of Foreign——in Flour. See Section 6.

Flour: Maturing. See Section 6.

(C)—WEAVING.

Loom; Power Absorbed by——. La France Text., 1922, 437.
The loom on which these power calculations are based is one of 915 mm. reed space, weaving cloth having 60 threads of warp and 56 picks per greater decimeter, running at 120 r.p.m. The pick is calculated as absorbing 0·12 metric h.p. That absorbed by the slay and the shed are purely frictional, and that absorbed by the beam is calculated at ·002 metric h.p. —A. H. M.

Loom Shuttle; Method of Operating——Electrically. Rev. Text., 1922, **20**, 773.
The passage of the shuttle completes the circuits through a series of solenoids arranged along its path, thereby giving the shuttle, which is fitted with soft iron end pieces, successive forward impulses. The circuits are afterwards automatically broken. —L. I. R. A.

Defects in Cotton Cloth; Classifying——. See Section 6.

The Mammoth Loom. See This *Jl.* (Proc.), 1922, **13**, 155.

(D)—KNITTING.

Latch Needle Circular Ribbers. G. R. Merrill. Cotton, U.S.A., 1922, **86**, 739-743.
An illustrated discussion of the arrangement of the adjustable parts of the pattern mechanism of latch needle circular ribbers for the construction of a half-hose cuff. —J. C. W.

(E)—LACEMAKING AND EMBROIDERING.

Industries of the Island of Gozo. See Section 1C.

(G)—FABRICS.

Artificial Silk Waste; Use for——. See Section 1D.

PATENTS.

Warp Twisting-In Machine. J. H. Becker, Brooklyn, N.Y., Assr. to Warp Twisting-In Machine Company. U.S.P. 1,424,276, 1/8/22; Appl. 24/11/20.
A means of thread twisting, including twisting members, one of which is movable against the other. —T. L.

Knitting Machines. Wildt and Co., Ltd., and E. Wildt, Leicester. E.P.181,846, 26/6/22.
Vertically striped or spotted effects are obtained on a machine with stationary needle cylinder by the use of two threads, one of which can be held from certain needles by the action of a pattern-controlled cam. —T. L.

Looms: Letting Off Warps. W. Gledhill, Blackburn. E.P.181,817, 19/6/22.
In a loom weighting motion having spring-controlled levers, the normal tension on the warp threads is relieved at intervals by one or more cam or tappet actuated levers. —T. L.

Lace Machine Carriages. G. Cholerton, Southwell, Notts. E.P.181,549, 22/6/22.
This relates to the bobbin carriages of lace machines and regulation of tension as the bobbin empties. —A.

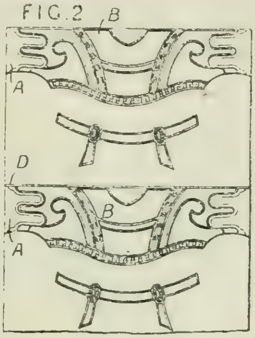
Woven Fabrics. W. A. Jukes, London. E.P.181,410, 21/6/22.
A leno fabric for making underwear may have a wool weft thread and silk and flax warp threads, or silk weft and wool and flax warp threads so that, at the same time, it retains heat and electricity and yet is absorbent and wear-resisting. —T. L.

Size; Mixing——. Hans Serrf. G.P. 351,452. Chem. Zentr., 1922, iv., 163.
The addition of a fused mixture of Japan wax and zinc oxide to warp sizes leads to better breaking down of the potato flour, and to smoother and stronger threads. —J. C. W.

Patterned Textile Fabrics; Process for——. H. Giesler, Brussels, Belgium (to Heberlein and Co., Switzerland). U.S.P. 1,425,520, 15/8/22; Appln., 10/11/14.
Comprises the weaving of a fabric of substantially all vegetable yarns, some of which have been previously treated with a chemical to aid carbonisation, then applying a neutralising agent to certain areas of the fabric, including both the treated and untreated vegetable yarns of the fabric and according to the design to be produced, then subjecting the fabric to carbonisation and then removing the carbonised yarn. —A.

Soluble Starch; Preparation of——. F. Supf. G.P.351,370. Chem. Zentr., 1922, iv., 257.
Directions are given for preparing a starch which can be made into a paste with cold water. Starch is treated with concentrated caustic alkali at low temperatures (0° and under) so that no pasting takes place. The quantity of alkali is so regulated that in the reaction which sets in as the temperature rises the starch grains burst but pasting is avoided. Suspension of the starch in water-repellent liquids previous to the treatment with caustic alkali is not necessary. The product can be used with advantage in sizing, finishing and calico printing. —J. C. W.

Fabrics. E. V. C. Weyand, New York, U.S.A. E.P.181,441.
A material for garments such as blouses having the characteristics of hand-decorated garments is produced by printing by means of a printing-roll or block printer, on a strip of silk fabric, etc., a uniformly recurring ornamentation or series of grouped designs, each group comprising characteristic motifs, such as neck parts B. (Fig. 2) and sleeve parts A. —T. L.



Knitting Machines. F. W. Robinson (to Nolde and Horst Co., Reading, Pa.). U.S.P. 1,425,288, 8/8/22; Appln., 24/4/19.
Refers to tucking mechanism, with intermittently operative means for positive withdrawal of tucking cam extension.—A.

Pile Fabrics, etc. B. Wilson, Batley. E.P. 183,235, 19/7/22.
In manufacturing fringe rugs, etc., the yarn, hair, or other fibre is wound on to a frame comprising two blades with serrated edges. The yarn is sewn or stitched to canvas or like foundation, then the frame is removed, whereupon the twisted yarn takes up a curled formation. The invention is applicable to the manufacture of imitation skin rugs, etc., and the fibres may be cut after attachment to foundation. —A.

Electrical Driving of Looms. Léonard. F.P.525,509; Appl. 20/10/20.
The driving shaft of the loom is combined with a shaft which is bound to it and bears a wheel with screw, gearing into an endless screw on a third shaft directly bound to the shaft of the electrical motor. The driving shaft of the loom and a countershaft are bound together by means of gears disposed on the same side of the frame as the electrical motor. The countershaft is bound to the shaft bearing the wheel with screw. The endless screw is combined with disposals of regulable catch disposed on each side of this screw and preventing the latter from shaking loose.—Bur. Text.

Loom. J. C. Brooks, Paterson, U.S.A. U.S.P.1,426,351, 22/8/22; Appln., 4/10/19.
In a loom, the combination with means to place separate picks of weft thread into the shed with the end of each pick projecting beyond the edge of the web or warp threads, and of means, including pneumatic devices, to bend each projecting end of weft thread backwardly and insert it in the shed. —A.

Braiding Machines. G. Perron, Paris. E.P.182,799; Conv., 5/7/21.
A machine in which flat or tubular lace, braid, trimmings, etc., can be made, and in which the bobbin carriers move in serpentine paths, is adapted for high-speed operation and for the use of materials such as fine silk or artificial silk. —A.

Looms: Weft-feeler Arrangements. British Northrop Co., Ltd., Blackburn. E.P. 182,992, 20/7/22.
Provides, amongst other things, for prevention of premature or accidental operation of the feeler mechanism. —A.

Looms: Letting-off Warps. T. H. Brigg, London. E.P.183,227, 18/7/22.
Apparatus, as described in parent specification (162,695) for regulating and maintaining a uniform tension of the warp. —A.

Looms: Bobbin Stripper for Automatic——. J. T. Malloy, Lowell, Mass. U.S.P. 1,423,670, 25/7/22; Appl., 13/3/20.
In a weft-replenishing loom, having frame, breast beam and lay beam with a bobbin passage, the combination of a trap comprising side bars pivoted to the lay beam and a cross-bar connecting them, leaving a bobbin passage, a spring adapted to keep the trap normally closed and a dagger attached to the frame in such position as to so engage the trap as to open it during part of the period of the lay beam's movement to and from the breast beam. —A.

Knitting Machines: Automatic Tension Control. J. Lawson, Central Falls, R.I. U.S.P.1,424,025, 25/7/22; Appl. 2/3/14.
A circular machine with a plurality of guides for corresponding plurality of threads, take-ups, and pivoted tension devices, one for each of the threads, each take-up and corresponding tension device being structurally distinct and independent of the others. —A.

Looms: Let-off Motion. S. Ingham, Pawtucket, R.I. U.S.P.1,421,241, 27/6/22; Appl., 15/5/20.
For warp beams and the like, the device consists of opposed complemental friction disks secured together and to the warp beam, an interposed ratchet disk, means for relatively adjusting the friction disks to vary the frictional contact between the same and the ratchet disk, and means for securing the ratchet disk against rotary movement. —A.

Looms; Picker-stick Check for——. W. F. Clayton, Huntsville, Ala., U.S.A. U.S.P. 1,421,172, 27/6/22; Appl., 25/1/22.
A check including a frame supported beneath the lay and a buffer member mounted for vertical and angular adjustment upon the frame and disposed in the path of the picker-stick. —A.

Loom for Weaving Cord Tyre Fabrics. F. C. Hall, Assr. to Jenckes Spinning Co., Pawtucket, R.I. U.S.P.1,421,081, 27/6/22; Appl., 12/10/21.
Comprises the combination with the harness and lay of mechanisms for feeding in to the harness, for each shed, lengths of warp threads which progressively increase from the centre of the fabric toward the edges, and for taking up a uniform length of fabric. —A.

Looms: Shuttle. F. Crossley, Todmorden. E.P.180,017, 12/5/22.
In hand-threaded shuttles having diagonal and horizontal slits and a tube made by bending a shaped sheet-metal stamping and fixed transversely in the shuttle body, the tube has a side slot, an open eye, a bottom slit, and a beak for preventing unthreading of the weft. The tube is secured in the shuttle by a pin passing through holes in the tube. —A.

Knitting Machines. W. Spiers, Leicester. E.P.180,187, 25/5/22.
A free-wheel or one-way clutch is combined with a friction device for oscillating the sinker cam during rotary reciprocating knitting, so that the friction device is inoperative during round-and-round knitting. The invention is applicable to the type of machine described in Spec. 24290/12 and to other types. —A.

Looms: Loose-reed Motions. R. F. Entwistle and W. Heap, Darwen. E.P. 180,529, 1/6/22.

A yielding or movable member, which may comprise a metal fitting attached to a U-shaped spring secured to a bracket adjustable along the back of the lay, supports an arm on the stop-rod but yields to allow the reed to be thrown out when the shuttle is trapped. At the beat-up, the fitting is interposed between the arm and a stationary abutment whereby the arm and the reed-case controlled thereby are firmly held. —A.

Looms: Brakes. J. W. Booth and T. C. Corlass, Keighley. E.P.180,720, 29/5/22.

In loom let-off mechanism the weighted lever which is connected to the brake-applying device is pivoted on a pulley carried by a spindle, etc., engaged by links connected by flexible connections, a cross-head, and a flexible connection to a lever on a shaft carrying another lever pressing against the warp on the beam so that as the diameter of the warp varies the pulley is moved to vary the position of the fulcrum of the lever, thus varying the amount of brake. —A.

Fabrics: Warping and Beaming Yarns. J. Orr and Sons, Ltd., and C. Johnson, Manchester. E.P.180,761, 6/6/22.

Cotton voile fabrics are made from yarn previously dyed in the cheese. In order to prevent the yarn from becoming slack during the beaming operation, the cheese is carried on a barrel loosely mounted on a creel peg having a flange, a spring having a flange being interposed between the end of the barrel and the first-named flange and the peg being mounted in bearings. After beaming, the yarn is maintained under tension by felt-covered rods carried by spring clamps engaging the warp-beam flange. —A.

Knitting Machines. A. Gillier, Troyes, France. E.P.180,773, 8/6/22.

For the production of mock-ribbed or other work with long sinker loops on machines of the Cotton type, the ordinary sinkers and knocking-over bits are replaced at the points where slack loops are required by instruments with more prominent thread-engaging portions than are ordinarily employed. —A.

Knitting Machines. Wilcock, Wood and Co., Ltd., J. Holroyd and S. J. Bennett, Shipley. E.P.180,873, 8/6/22.

Stop-motion for circular machines, acting on breaking or failure of the yarn and used in connection with the stop-motion described in Spec. 141,476, which is put into action by occurrence of faulty knitting. —A.

Looms: Dobbies; Pattern Surfaces. C. A. Zackiewich, Paris. E.P.180,691; Conv., 28/5/21.

The "wire holders" of a loom are actuated by means of cords from grooved pulleys, which are turned in one direction or the other by means of worms on shafts gearing with worm wheels. A dog-clutch sliding on each shaft is moved by a clutch-fork into gear with either of two pinions which continuously rotate in opposite directions whereby the shaft is turned in one direction or the other and the corresponding "wire holder" is accordingly raised or lowered. —A.

Hosiery; Fashioned——. G. P. Bosworth, Central Falls, R.I., Assr. to Hemphill Co. U.S.P.1,418,617, 6/6/22; Appl., 12/8/19.

A fashioned stocking has a strip of fabric formed by reciprocating knitting and including toe and heel pockets and a calf portion fashioned by varying the number of wales upon opposite sides of the leg, and a continuous wale of loops extending along the edges of the said strip, the loops being substantially longer than the loops comprising the strip. —A.

Knitting Machines: Electrical Stop-motion. E. S. Hineline, Providence, R.I. U.S.P.1,417,914, 30/5/22; Appl., 11/1/22.

Has, in combination, shipper mechanism, an electro-magnetic circuit and an armature, a contact, a rod having an up-and-down movement and at its lower end portion a contact to engage the first-mentioned contact, and a lever at the upper end portion of and connected to the rod, and having an open end out of which the yarn may slip on the occurrence of undue tension. The arrangement provides for electrical contact prior to yarn slippage and without putting appreciable strain on the yarn. —A.

Looms: Smallwares. F. M. Stone, Manchester. E.P.180,793, 8/6/22.

Refers to the weaving of endless belts with woven selvedges, the warps being shed by reeds which are moved up and down in supports by means of rollers, etc., resting on levers connected by links to levers operated by cams on a shaft geared to the first-motion shaft. —A.

Looms: Selvedge Shedding Mechanism. E. Bury and J. Wilkinson, Skipton. E.P.180,815, 8/6/22.

The two treadles controlled by the ordinary tappets and operating the main heald mechanism are connected by straps to an additional shaft which operates the selvedge mechanism by means of a tape passing round a collar mounted centrally or otherwise on the shaft. —A.

Fabrics for Tyres. Tape Tyre Cor., Seattle, Washington, U.S.A. E.P. 180,995; Conv., 3/6/21.

A number of woven tapes, preferably made by cutting a web of fabric into strips, are passed together with a sheet of rubber, between calender rolls so that the interstices between the tapes are filled with rubber. A second sheet of rubber may be applied to the other side. The web thus formed is cut on the bias to form strips for pneumatic tyre manufacture. —A.

Looms: Changing Weft-carriers, Take-up Motions, and Checking Shuttles. Cotonificio Honegger Soc. Anon., Albino, Italy. E.P.178,794.

Covers mechanism for each movement mentioned. When the weft fails, etc., a shaft is turned by the weft-fork mechanism, an adjustable bolt on one arm of a two-armed lever on the shaft raising a feed-arm whereby pirn-changing mechanism is actuated, whilst a projecting piece on the other arm operates a hand-lever of a disengaging mechanism whereby the take-up motion is arrested and the cloth beam is turned back for a short distance. As the lay moves forward, the raised feed-arm engages a pin and turns a pirn-inserting hammer against the action of a spring whereby a spare pirn is transferred into the shuttle. The weft-ends from the spare pirns pass through a tensioning device, and the weft-end from the freshly inserted pirn is cut off by shears. A device, also described, is provided for checking the shuttle and bringing it into correct position in the shuttle-box for pirn changing. —A.

Looms: Loose-reed Motion. Maschinenfabrik Ruti vorm. C. Honegger, Ruti, Switzerland. E.P.178,817; Conv., 22/4/21.

In a loose-reed power loom wherein the reed is adapted to be locked to the lay by a clamping bar coupled by at least one traverse member to a reciprocating locking-bar, all the parts required for the operation of the locking-bar are mounted on the lay, and the positively controlled displacement of the locking-bar is derived from the oscillation of the connecting-rod through intermediate members. —A.

Loom Shuttle. S. Krawczyk and A. Konig, Plainfield, N.J. U.S.P.1,416,095, 16/5/22; Appl., 3/5/21.

A split spindle is provided in combination with shuttle body and a lever pivoted to the body operates so as to expand the spindle when swung into position and contract when raised out. —A.

Lubricant. E.P.179,344. See Section 7.

4.—CHEMICAL AND OTHER PROCESSES.

(C)—WASHING.

Cyclohexanol: Application. See Section 5.

(G)—BLEACHING.

Chlorine; Action of——on Bleaching. Textilchem., 1922, 39.

An account of the author's views as to the action of bleaching powder solutions. The effect of the reaction of the bath, whether alkaline or acid, is said to be of great importance. An alkaline bath in which the active agent is probably calcium hypochlorite, is not likely to damage the material. When the bath has been in use and become acid the addition of soda is necessary if the possible presence of free chlorine is to be avoided. —L. I. R. A.

Linen; Bleaching——. Rasser. Chim. et Ind. (from Chem. Tech. Ind., 1921, **19**, 457-459), 1922, **7**, 764.

Tendering of linen is said to be due to a finely divided deposit of calcium carbonate which coats the fibres, prevents bleaching, and causes subsequent yellowing. Calcium hypochlorite is consequently dangerous for linen. The author recommends electrolytic sodium hypochlorite and describes its preparation and application. —J. C. W.

Absorbent Cotton; Preparation of——. Posselt's Text. Jl., 1922, **30**, 95-96.

A general account of the principal mechanical and chemical operations employed in the preparation and sterilization of absorbent cotton. New Orleans, Texas, Allen Seed, Mebile and Benders of middling grades are the most suitable cottons for this purpose. —J. C. W.

Chlorine; Determination of Free—and Hypochlorous Acid in Concentrated Salt Solutions. See Section 6.

(I)—DYEING.

Dyeing Material Containing Pulled Wool to Which Particles of Skin Adhere. G. E. Templeton. Amer. Dyestuff Reporter, 1922, **11**, 9.

New Zealand pulled wool sometimes has pieces of skin adhering to the fibre. This skin has a greater attraction for dyestuffs than has the wool; goods dyed with an organic acid, and goods dyed with sulphuric acid and after-dyed with direct colours, only showed the fault. It was found that bleaching with permanganate, sodium bisulphite and sulphuric acid completely prevented the formation of the deeper coloured specks due to the greater affinity of the skin for dyes. —H. R. H.

Formaldehyde-Phenol Condensation Products; Use of——in Dyeing and Printing Textiles. A. Beyer. Rev. Text., 1922, **29**, 925-929.

Attempts have been made in two directions to use the condensation products of formaldehyde and phenol or its homologues (resorcinol, naphthol and sulphonated phenols) in the dyeing and printing of textiles. In one case substitutes for tannin have been sought for, and in the other case adhesive agents suitable for use in printing processes with metallic powders. Up to the present the use of such products in place of tannins has been retarded by a lack of fastness to light of the dyed goods. The use of the products from sulphonated phenols (neradol, tannol) as a resisting agent with acid colours on wool has met with some success; the use of such products as degreasing agents has also been examined. Receipts and references to literature and patents are given in the original article. —L. I. R. A.

Dyeing of Linen. E. Greenhalgh. Cleaners' and Dyers' Rev., 1921, **9**, 46-47.

The penetration of the dyestuff is difficult in the case of linen, owing to the hardness of the fibre. It is necessary to dye at the boil in order to facilitate penetration, and easily soluble dyestuffs should be used. The addition of soap, Turkey red oil and other agents which favour thorough wetting of the material is recommended. The dyestuffs which are most frequently used for linen are the direct dyes, the basic and sulphur dyes and the vat dyes, such as indigo. In using direct dyes the procedure is as follows:—To 26-30 galls. of boiling water are added ½ gall. olein and 1-2 lbs. soda and then the dyestuff dissolved and finally some glauber's salt. The bath must be kept boiling throughout the dyeing. In using basic dyes the tannin solution should be used hot, as otherwise the tannin is not taken up well. The addition of a little acetic acid to the tannin bath is recommended. The addition of olein to the dye-bath serves to equalise the dyeing, and the more soluble and faster dyes only should be used. With sulphur dyes the addition of soda to the bath is not to be recommended, but soap and sodium sulphide should as a rule be the only additions; a small percentage of glucose is sometimes beneficial. It is often necessary to oxidise the dyestuff by an after-treatment with bichromate. —L. I. R. A.

Dyeing of Yarn in Hank Form. H. Lagache. Rev. Text., 1922, **20**, 817-821.

Further machines are described in which there is a circulation of the dye-bath. Methods which are in use or which have been proposed for the dyeing of yarns in hank form are described, and also methods in which the hanks are joined in order to allow of treatment in the form of continuous bands. —L. I. R. A.

Bobbins; Dyeing Cross-Wound——. Rev. Text., 1922, **20**, 939-943.

The process devised by M. Fastenaekels, of Wattrelos (Nord), is described. The bobbins or tubes are removed from the packages of wound yarn and the latter are placed in perforated nickel tubes to the number of eight (or less, according to size) one above another. Discs are placed above and below each set which allow a gentle pressure to be exerted so as to prevent the dye liquor from escaping without passing through the yarn. The dye liquor is forced by a suitable means into the nickel tubes and passes, via the perforations, through the packages of yarn, giving, it is claimed, a very uniform result. After dyeing and rinsing the yarn is returned to the bobbins. Several advantages are claimed for the process, among which may be mentioned (*a*) large output at small cost, (*b*) easy cleaning of apparatus, (*c*) absolute uniformity of dyeing, (*d*) small requirements as regards labour, (*e*) economy of tubes.—L. I. R. A.

Automatic Hank Dyeing Machine. T. Lang. Textilberichte, 1922, **3**, 287-288.

A machine for squeezing out cotton yarns, after dyeing with indigo and other vat dyes, is described. The yarn is held on specially shaped iron rods, which allow it to be completely immersed in the dye liquor contained in a rectangular vat at one end of which is mounted a wringer consisting of two rubber-covered rollers which can exert a pressure of several thousand kilograms. At the end of the dyeing process the yarn is automatically carried towards the wringer, raised from the vat and passed between the rollers by means of a device attached to the rollers. The dye liquor squeezed from the yarn runs back into the vat. —J. C. W.

Indigo; Application of——. W. B. Nanson. Cotton, U.S.A., 1922, **86**, 695-697.

In continuation of the previous article (This *Jl.* Abs., 1922, **13**, 164) detailed directions are given for dyeing and printing with synthetic indigo. —J. C. W.

Sulphur-Black Dyed Cloth: Tendering. J. Beckering Vinckers. Mededeel. Rijksvoorlichtingsdienst Vezel., Delft, 1922, 26-27.

The author discusses the risk of the production of sulphuric acid in fabrics dyed by sulphur colours, and the various processes for diminishing this risk. The acid originates partly from free sulphur, but chiefly from the dye itself, and heat, as in the Schreinering process, and the presence of heavy metals, especially copper and iron, favour the oxidation. Figures are given which show how the breaking load of the fabric decreased and the percentage of sulphuric acid increased as a black-dyed sail cloth was heated for several hours at temperatures of 100-130°C.

—J. C. W.

Cross-Wound Spool; Dyeing——. O. Caspari. Textilberichte, 1922, **3**, 286-287.
The development of processes for the dyeing of cross-wound spools is traced, from the introduction of such a system of winding to the introduction of the recently described "spindleless" dyeing device (This *Jl.* Abs., 1922, **13**, 104). —J. C. W.

Dyeing of Acetyl Silk. C. Raglan. Dyer and Calico Printer, 1922, **48**, 6.
A continuation of the article previously abstracted (This *Jl.* Abs., 1922, **13**, 163). Direct colours may be dyed in one bath:—For 100 lb. of fibre use 100 gall. water and 2½ pints of 70°Tw. caustic soda, dye at 170°F. for ½ hr. and allow to cool. If the soda bath is used separately, the dyeing is started cold and raised to 100°F. Developed azo dyes are said to give good results. Vat dyes may be used; a recipe is given for Duranthrene Blue CC paste. The preliminary soda treatment should also be given in these cases. Ammonium sulphocyanide is said to be very effective as a pre-treatment for increasing the affinity of acetyl fibre for all classes of dyes. Logwood is stated to have little effect. —F. G. P.

Artificial Silk and its Applications in the Textile Industry. See This *Jl.* (Proc.), 1922, **13**, 145.

Phosphorescent Sulphide; Application of—. See Section 4J.

Azo Dye; Estimation of——. See Section 6.

(J)—PRINTING.

Neutral Chromates and Bichromates; Use of——for Vigoureux Printing on Wool. J. M. Gaudit. Assoc. Chimistes Ind. Text. Rev. Mensuelle, 1922, **12**, 111.
The employment of bichromates for printing on wool is not of universal application, and in order to measure the premature precipitation of the colour lake which would occur with many mordant dyestuffs neutral chromate of potash is substituted and the necessary acid added as an ammonium salt. A list of suitable colours is given, with particulars for mixing the paste. —H. R. H.

Phosphorescent Sulphide; Application of—. S. G. Schimanský. Chem. Zentr. (from Ber. Polytechnikum Iwanowo-Wosniessensk, 1921, **4**, 171-172), 1922, iv, 318-319.
Phosphorescent sulphide mixtures have been printed on cotton fabrics with ammoniacal albumen. The luminosity was not reduced on keeping, but was destroyed by a trace of acetic acid. Negative results were obtained from experiments in which acid dyestuffs, such as eosin, fluorescein, etc., were used. —J. C. W.

(K)—FINISHING.

Silk Weighting; Water in——. E. Gagliostro. Dyer and Calico Printer, 1922, **48**, 97.
The most suitable water for use in the washing bath that comes directly after the impregnation of the fibre with the tin solution is one possessing about 50 to 100 parts per million of hardness. Temporary hardness due to bicarbonates is to be preferred to permanent hardness due to sulphates or chlorides. Also the hardness due to magnesium compounds is of doubtful value. The water to be used for washing after the phosphate treatment, on the other hand, should be as free from hardness as possible. The lime-soda method is generally employed to soften the water for this purpose—water softened by this process can usually be reduced to about 25 parts per million of hardness—also the zeolite process is being used more and more in silk weighting establishments, as a water of as low as zero degrees of hardness may thereby be obtained. The advantages of using water of such a low degree of hardness are that the sodium phosphate bath is more readily maintained in a state of purity and uniformity, there is less loss of phosphate, and the lustre and good quality of the silk are better preserved. —L. M. S.

Nap-Raising Machine: Control. K. Schneider. Textilberichte, 1922, **3**, 288-289.
A short general account of the method of production of napped surfaces, of various lengths and thicknesses, on one or both sides of bleached and unbleached cotton and woollen fabrics. —J. C. W.

Linen Finish: Production of a Permanent Silk-like "Handle." Textilberichte, 1922, **3**, 288.
The addition of an emulsion—formed by boiling together joiners' glue, 4% by weight; olive oil, 1%; formic acid, 1—2%—to the slightly acid washing bath, which follows the mercerisation (or dyeing) process, is recommended for the production of a permanent silk-like handle on linen, cotton, jute, etc. —L. I. R. A.

Defects Developed During Wool Cloth Finishing. See Section 6.

(L)—WATERPROOFING.

Waterproofing and Mildewproofing Textile Fabrics; Some Chemical Aspects of——. W. H. Adams. Amer. Dyestuff Reporter, 1922, **10**, 334-335.
Waterproofing is confined largely to cotton fabrics. For complete protection of the fabric waterproofing must accompany mildewproofing, since the living organisms

which are the most active agents in the destruction of cellulose fibre all require moisture. The destructive agents are algae, which require a continuous supply of water; mucors, which require moisture and darkness; and fungi, the most destructive class, the spores of which are universally distributed. Algae are poisoned by copper in solution; mucors require treatment with organic resinates; fungi must be treated with disinfectants, such as phenol, cresol, and pyridine, all of which must be mixed with suitable retaining ingredients which fix them on the fibre and prevent volatilisation. The various substances thus used are discussed in a general way. A recent method is to saturate the fabric with an ammoniacal copper solution and drive off the excess of ammonia, when the fibre remains coated with a copper cellulose compound which is water-repellent and mildew-proof. —J. C. W.

Waterproofing Linen Goods. P. Rausch. Textilberichte, 1922, **3**, 325.

A process of waterproofing linen goods is described which depends on the use of a copper salt. The operations are divided into the following stages:—(1) Mordanting—sugar of lead; (2) soaping—the soap solution includes copper sulphate and ammonia among its ingredients; (3) dressing; (4) calendering or mangling. Contrary to the opinion expressed by H. Schmidt, the author believes that waterproofing processes involving the use of ammoniacal copper solutions possess considerable possibilities. —L. I. R. A.

PATENTS.

Finishing Artificial Silk Thread. C. A. Snyder, Philadelphia. U.S.P.1,423,041, 18/7/22; Appl., 3/9/21.

A composition is used consisting of olive oil soap dissolved in water having olive oil added thereto. —A.

Fabrics and Yarns and Removal of Starches, Gums, etc. J. Takamine, New York. U.S.P.1,421,613, 4/7/22; Appl., 8/10/20.

Comprises subjecting to a bath containing proteolytic and diastatic enzymes for dissolving the substances, and then washing in water. —A.

Coated Fabrics. E. C. R. Marks, London (Duratex Co., New Jersey, U.S.A.). E.P.180,705, 24/5/22.

Imitation leather is made by embedding the nap of a pile fabric in a coating of flexible material such as pyroxylin or other cellulose ester mixed with a vegetable oil such as blown castor oil or a coating of rubber compound. —A.

Kapok and other Fibres; Process to Render——Incombustible. R. C. Valls, Barcelona, Spain. U.S.P.1,422,242, 11/7/22; Appl., 1/6/20.

For kapok and other fibres having an impermeable outer cuticle or envelope, the process consists essentially in treating the fibre with a volatile solvent of low boiling point such as alcohol and of rendering it permeable, and in also treating the fibre with ammonium phosphate which is capable of rendering the mass of the fibres incombustible by its penetration inwardly while the outer cuticle or envelope is in a permeable state. —A.

Mercerising Yarns. J. F. Copley, Thongsbridge, near Hudersfield. E.P.180,739, 25/5/22.

In machines for mercerising hank yarns, the hanks are extended between rods or bobbins permanently attached to traversing chains. The hanks are stretched by arranging that the distance between a pair of rods or bobbins is greater than the normal length of the hank carried thereby, the strain or pull being thus borne by the hanks during the straight traverse of the chain. Means are provided for tensioning the hanks, for varying the tension in different sections of the machine, and for turning the hanks to change their positions on the rods or bobbins. The chain or a pair of chains is traversed through a mercerising tank and washing tanks.—A.

Method of Controlling the Stabilizer Content of Cellulosic Colloids. G. Rocker, Wilmington, Delaware, Assr. to Pont de Nemours and Co. U.S.P. 1,424,212, 1/8/22; Appl., 17/12/20.

This comprises washing the colloid with a solution containing the stabilizer, and then washing the colloid in a liquid in which the solvent of the stabilizer is miscible and the stabilizer is insoluble. —T. L.

Mordant: Manufacture of Soluble Condensation Products. A. Lüttringhaus and L. Blangey, Mannheim, Germany, Assrs. to Badische Anilin u. Sodafabrik. U.S.P.1,412,949; Appl., 8/11/20.

A solution of cellulose in concentrated sulphuric acid is treated with naphthalene as long as sulphonate is formed by the addition, and the product is then poured into water, neutralised with calcium hydroxide, separated from calcium sulphate and converted into the sodium salt with sodium carbonate. The compound thus prepared is adapted for use as a mordanting, tanning, or lake-forming agent. Similar products may be obtained by the use of starch, dextrin, or sugars instead of cellulose, and by the use of methylnaphthalene, chloronaphthalene, naphthalene sulphonic acids, anthracene, phenanthrene, or carbozole instead of naphthalene. —J. C. W.

Fabrics; Means for Stiffening. O. Lobeck, Leipzig, Germany (Assr. to Chemical Foundation Cor.). U.S.P.1,421,700, 4/7/22; Appl., 8/5/18.

A soluble composition of powdered gelatin in admixture with a desiccating agent is employed. —A.

Wood Pulp: Bleaching. J. C. Baker, Assr. to Wallace and Tiernan Co., N.J. U.S.P.1,413,154; Appl., 18/7/21.

If in the bleaching of wood pulp by means of bleaching powder an excess of free chlorine, preferably as chlorine water, is added to the mixture, the bleaching operation is more rapid, the final colours obtained are much whiter, and less bleach is required to produce a given effect. Even better results are secured at temperatures of 100° to 110°F. —J. C. W.

Dyeing Cellulose Ethers. L. Lilienfeld, Vienna. E.P.181,391—181,395; Conv., 13/6/21.

(1) Cellulose alkyl ethers which are insoluble in water at 16°C., but swell or dissolve in water at lower temperatures, are swollen by treatment with solutions of glycerine, sugars, soaps, Turkey-red oil, acids, etc., in water at an appropriate temperature and dyed. (2) When these ethers are soluble in water or swell in cold water, they are made insoluble or the property of swelling is substantially reduced by treatment with a reagent having the property of a precipitating albumen. This treatment may be applied to articles prepared from these ethers, *e.g.*, artificial silk, sizes, coatings and dressings for textiles, or plastic masses. (3) These ethers are prepared from cellulose or cellulose conversion products by treatment with an alkylating agent in the presence of water and caustic alkali. The ethers may be used in the manufacture of dyes, artificial silk, dressings for textiles, etc. (4) Artificial silk, hair, etc., are prepared by spinning solutions of these ethers; the products may be readily dyed. (5) When these ethers are treated with caustic alkali and alkylating agent so that the content of alkali in the alkylating mixture is not less than one-tenth and not more than one-quarter of the quantity of water present, they are prepared by treating an alkyl ether soluble in water at 16°C. with caustic alkali and an alkylating agent. —T. L.

Treating Fibres, etc. Akt.-Ges. für Anilin-Fabrikation, Berlin. E.P.181,698; Conv., 15/6/21.

Animal fibres are protected from damage during treatment with alkaline liquids by adding to such liquids an aldehyde bisulphite or a ketone bisulphite compound. —T. L.

Dyeing Cellulose: Dyeing with Vat and Sulphuretted Dyes. Courtaulds, Ltd., and L. J. Wilson, Coventry. E.P.181,902, 29/6/22.

Threads, filaments, strips, or films of cellulose are dyed with vat or sulphuretted dyes by incorporating with viscose the leuco compound of the dye. —T. L.

Treating Yarns, etc.; Bearings. Lee and Sons, Ltd., and G. Pinder, Wakefield. E.P.181,506, 19/6/22.

A bearing for an agitator spindle of a machine for dyeing hanks of yarn.—T. L.

Bleaching. C. Bochter, Gunzburg, Germany. E.P.182,776; Conv., 4/7/21.

Loose cotton and cotton yarns or fabrics are bleached by first treating with a soda lye containing soluble hydrosulphites, preferably in a vacuum at temperatures below 100°C., and then bleaching by means of other bleaching agents, such as hypochlorites, hydrogen peroxide, persulphates, etc. Sodium or ammonium hydrosulphites may be used, and goods may be scoured and washed during bleaching. —A.

Bleaching; Process and Materials for——. H. B. Smith, New York. E.P.183,424; Conv., 19/7/21.

Material such as cotton containing motes, shives, or leaf is bleached by blueing the material as with an acid dye such as alkaline blue and treating with an alkaline oxidizing bath. Spec. 103,445 referred to. —A.

Dyeing Textiles (Unions). R. Clavel, Basle, Switzerland. E.P.182,844, 10/7/22.

The cellulose acetate portion of mixture fabric is dyed by means of the non-sulphonated or monosulphonated dyes containing " active " groups mentioned in Spec. 182,830, whilst the non-acetate portion is dyed with direct, acid, mordant, or other appropriate dyes. The acetate portion may be dyed first or vice-versa, or a single bath may be employed containing both the dyes; or one of the dyes suitable for the acetate and having also affinity for the non-acetate may be used alone. —A.

Dyeing Cellulose Acetate. R. Clavel, Basle, Switzerland. E.P.182,830, 12/7/22.

Refers to dyeing goods (silk, films, etc.) direct in aqueous solution or suspension with non-sulphonated or monosulphonated soluble or insoluble dyes containing one or more of certain " active " groups mentioned. Spec. 176,535 is referred to. —A.

Impregnating Fabrics. Smith and Co., London, and A. C. Ellis, Hornchurch. E.P.183,319, 27/7/22.

A liquid coating is made to penetrate a fabric by passing the fabric over a slot in an evacuated tube. —A.

Treating Fibres with Liquids. Messrs. Brandwood (Elton Cop Dyeing Co., Bury). E.P.182,575, 10/7/22.

Loose textile material in the unspun state is dyed, bleached, or otherwise treated by passing it below the level of the liquor in the treating-tanks in lap or equivalent packed form between flexible open woven or meshed conveyors forming a container held in tight contact with cylindrical or plane perforated surfaces, or both, which are arranged in the tanks, means being provided for closing any perforations not covered by the container. Treating liquid or air is passed through the perforated surfaces, the container, and material held therein. —A.

Treating Animal Fibres. A. G. Bloxam, London (Technochemia Akt.-Ges., Glarus, Switzerland. E.P.183,249, 20/7/22.

Animal fibre, such as pig or other hairs, and the like, is treated with chlorine. The oxidized fibre, probably a poly-oxi-amino acid, is then dipped in a bath containing excess of alkali, such as caustic soda or sodium carbonate. The slippery, transparent product is rinsed and, preferably after drying, treated with boiling soap solution, which produces a fibre of high lustre, increased strength and elasticity, and having a soft and silky feel which may be enhanced by treatment with a little acetic acid or by calendering after drying. —A.

Soluble Starch; Preparation of——. G.P. 351,370. See Section 3.

5.—LAUNDERING AND DRY-CLEANING.

Blue Dyes Used for Tinting White Goods in Laundries. Amer. Dyestuff Reporter, 1922, **11**, 130.

Ultramarine, smalt, or "cobalt blue" and insoluble Prussian blue or "Turnbull's blue" are discussed. Soluble Prussian blue may be successfully employed for laundry purposes, provided the use of caustic soda is avoided in subsequent laundering of the goods so treated. Aniline blues are dealt with, and the requirements for the selection of a bluing for laundry practice are given. —L. M. S.

Rugs; Cleaning——and Carpets. C. F. Goldthwait. Amer. Dyestuff Reporter, 1922, **11**, 109.

Deals with dusting appliances, the scouring process, "shampoo," rinsing, dry cleaning and the effects of dry cleaning. —L. M. S.

Cyclohexanol: Application. Chem. Age, 1922, **7**, 163.

If a small proportion of cyclohexanol is added to soap, the soap scarcely alters in consistency, but acquires the property of dissolving a considerable proportion of various hydrocarbons. Such compounded soaps dissolve easily in water, giving a thick permanent lather. They are excellent cleansing agents, particularly for fabrics, and will remove greases, waxes, mineral oils, etc. They are equally suitable for soft and hard water. —J. C. W.

6.—ANALYSIS, TESTING, GRADING, AND DEFECTS.

Effects of Alkali and Weathering upon the Wool of Range Sheep. J. A. Hill. Wyoming Agric. Expt. Sta., Bull. 131, 1922.

Experiments were undertaken to investigate "frowsy" or "mushy" wool; the wool lacks yolk and is hard, dry and weak. Artificial treatment of the wool on the sheep's back with sodium carbonate or magnesium sulphate caused no marked deterioration. The strength of the wool was not affected by covering a portion of a sheep with a blanket for half the period of its growth. Wool fibres exposed to the weather lost one-third of their strength in the first month and were completely destroyed in four months; in this case yarn was used for the test. Direct sunlight alone has practically no effect. The damage appears therefore to be due to other factors of weathering—oxidation and changes of temperature and moisture. The experiments of protecting a portion of the fleece were not conclusive, as in densely covered fine-wooled sheep only the tips would be exposed to weather. —H. R. H.

Cellulose Complexes; Transformations of ——During the Manufacture of Artificial Silk. W. Vieweg. Zellstoff u. Papier, 1922, **2**, 18-19.

The insoluble residue obtained by grinding cellulose with sodium hydroxide solution is the sodium alkyloxide of α-cellulose and reacts with carbon bisulphide, benzoyl chloride, and the like. An alkali solution having the formula $(C_6H_{10}O_5)_3$ NaOH is prepared by steeping cellulose in 18% caustic soda. It is unaffected by air or other oxidising reagents. Cellulose xanthates capable of being spun contain the complexes $(C_6H_{10}O_5)_3$ and $(C_6H_{10}O_5)_4$. —L. I. R. A.

Defects in Cotton Cloth; Classifying——. Cotton, U.S.A., 1922, **86**, 717-718.

A plea for standard terms to designate common defects in cloth. Some examples of extensively used terms, which are either comparatively meaningless, or incorrect, are quoted. —J. C. W.

Defects Developed During Wool Cloth Finishing. E. Midgley. Dyer and Calico Printer, 1922, **47**, 230, and **48**, 10, 32.

A detailed account of the examination and cause of finishing defects is given. Crimps are due to uneven shrinkage and movement of the fibre, arising from lack of uniformity in the materials or treatment. Streakiness may be due either to unsuitable combination of materials, such as mixtures of long and short wools; insufficient mixing of two materials, *e.g.*, coarse wool and mohair; irregularity in diameter and twist of warp and weft yarn. Streakiness may also be due to artificial "conditioning" of the yarn causing uneven shrinkage of the yarn—uneven drying of the yarn on the bobbins is another result of this treatment; the use of oils which during the crabbing operation become oxidised or polymerised and are thus not easily removed by the ordinary scouring process. Mixing different warp yarns may cause an uneven appearance. Too much or too little setting or fixing during crabbing will tend to allow uneven movement of the yarn fibres during subsequent finishing processes.—H. R. H.

Regain of Unwashed Wool. J. A. Hill. Wyoming Agri. Expt. Sta., Bull. 132, 1922.

The result of direct weighings of small samples of wool transported from mountain stations to the sea coast shows that the wool gains in weight; the greater the proportion of sand present in the wool the less the gain in weight on storage at the seaboard. The greater the amount of suint the greater the increase in weight under the same conditions; wool stored in bales and stored in closed warehouses only changes its moisture content very slowly.
—H. R. H.

Cotton Hair. W. Frenzel. Mededeel. Rijksvoorlichtingsdienst Vezel., Delft, 1922, 19.

The "fineness" of a sample of raw cotton is measured by carefully weighing 100, 200, or more hairs, stretching them out by means of glycerol on a glass plate lying on black velvet or cloth so as to measure the total length, and dividing this length by the weight. The "fineness" is thus recorded in metres per gram. —J. C. W.

Thermostat; Electric Heating and Controlling Apparatus for a Small——. S. O. Rawling. Jl. Soc. Chem. Ind., 1922, **41**, 250-251T.

Details and diagrams are given of this apparatus, by means of which it is possible to change from one temperature to another, within the temperature range of 25 to 40°C. without troublesome readjustments of heat supply and regulating gear.
—J. C. W.

Liquid: Evaporation. W. K. Lewis. Chem. and Met. Eng., 1922, **27**, 112-114.

A mathematical analysis of the mechanism of the evaporation of a liquid into a gas. An equation is derived, viz., $h/k=s$, in which h is the surface coefficient of conductivity of heat between gas and liquid, k is the coefficient of diffusion, or parts by weight of vapour diffused per unit time per unit area per unit vapour pressure difference, and s is the humid heat of the gas. Reference is made to the importance of this relationship. —J. C. W.

Flax and Hemp; Optical Methods of Distinction between——. A. Herzog. Text. Forschung, 1922, **4**, 58-61.

By the immersion method, the author has found the refractive indices of flax and hemp fibres for light polarised (*a*) perpendicularly to the fibre length, (*b*) parallel to the fibre. The corresponding indices in the two fibres are for sodium light (D line) so nearly alike as to preclude their direct use as means for distinguishing between the fibres. A method has been developed, however, in which a selenite plate (Red I) is used in conjunction with the polariser of the microscope, with its long axis at an angle of 45° with the plane of vibration of the incident light. When flax and hemp are illuminated with light passed through this system, it is found that with the axis of the two fibres in the same orientation in the one case a subtraction interference colour is produced, and in the other an additive colour, the differences being due to different inclination to the fibre axis of the optical ellipsoid of elasticity.
—L. I. R. A.

Organic Matter; Ashing. A. Schoeller. Ber., 1922, **55**, 2191-2192.

A microchemical method for the detection of mineral matter in organic substances is described. The substance is thinly and evenly spread on a strip of glass, 5-6 mm. in width, which is then introduced into a horizontally clamped tube of Jena glass, 10 mm. in diameter. The substance is charred by heating with a very small flame. The residue is cooled and a feeble current of moist oxygen is led through the tube. The residue is now rather more strongly heated. The smallest traces of ash can thus be detected, even the ash from a micro-section of plant material.—J. C. W.

Azo Dye; Estimation of——. E. Sifferlen. Bull. Soc. Ind. Mulhouse, 1922, **88**, 80.

If a solution of sodium hydrosulphite is treated with sodium citrate and acetaldehyde it can be kept for several days, without oxidation, in an atmosphere of carbon dioxide. This solution does not reduce safranine in the cold, but it reduces the azo colours quantitatively at boiling point. Benzaldehyde and furfuraldehyde do not give this result. —J. C. W.

Hydratometer. M. Guichard. Bull. Soc. Chim., 1922, **31**, 552-554.

A convenient apparatus for studying the absorption of water and other vapours by solids is described. The experiments are carried out in sealed evacuated tubes and no weighings are required. The solid is placed in a horizontal glass bulb to which is fused, at right angles, a calibrated tube closed at the end. The apparatus is evacuated and the liquid which is to furnish the experimental vapour is introduced into the calibrated tube. The bulb is then heated to a definite temperature and the quantity of vapour absorbed is determined by the level of the column of liquid in the calibrated tube, which is immersed in a bath at a constant temperature. —J. C. W.

Soap; The Effect of an Electrolyte on Solutions of Pure——. J. W. McBain and A. J. Burnett. Jl. Chem. Soc., 1922, **121**, 1320-1333.

An investigation of the effect of an electrolyte on solutions of pure soap. It is shown that the phase rule is directly applicable to such a system. Gelatinisation of one or both of the liquid soap layers does not affect the equilibria observed. Super saturation with respect to the formation of a liquid soap layer was never observed. There are three types of liquid layers, viz., " neat " or " fitted " soap, " nigre " and " lye," any pair of which may be in equilibrium under suitable conditions. The concentrations in these three layers have been ascertained. Addition of salt to solutions of sodium laurate reduces the solubility of the soap in a regular manner highly dependent on temperature and concentration. Addition of excess of sodium chloride at temperatures where two liquid layers have been formed ultimately results in the formation of curd floating on a lye containing only minute traces of laurate. Portions of the equilibrium diagram for the system sodium laurate-sodium chloride-water have been mapped out. —J. C. W.

Gelatin; The Dissolution of——. F. Fairbrother and E. Swan. Jl. Chem. Soc., 1922, **121**, 1237-1244.

It has been shown that when a gelatin jelly is in equilibrium with water or dilute acid or alkali, gelatin exists in solution in the liquid surrounding the gel. A number of determinations of the extent of this dissolution have been made, the precipitate of tannin with gelatin being used for the purpose. The " solubility " curves show a similarity to the swelling and osmotic pressure curves of gelatin. With the exception of the minimum " solubility " in the case of acids, gelatin dissolves to a greater extent in dilute acid or alkali than in water. Neutral salts decrease this " solubility." —J. C. W.

Tetracarnite: Wetting Power. W. von Herbig. Chem. Zentr. (from Z. ges. Textilind., 1922, **25**, 221-222 and 230-232), 1922, iv, 269.

A quantitative investigation of the wetting powers of water, soap, Turkey-red oils, bowking oil, Turkey-red oils with tetracarnite and tetracarnite alone, in which weighed hanks of yarn were steeped, centrifuged and weighed, indicates that tetracarnite increases the wetting powers of these liquids. The wetting power of tetracarnite increases with concentration. Hardening agents do not affect the wetting power of pure tetracarnite solutions. —J. C. W.

Photosensitised Colloidal Solution. N. P. Peskow. Chem. Zentr. (from Ber. Polytechnikum Iwanowo Wosniessensk, 1922, **6**, 101-104), 1922, iv, 314.

It is shown that the coagulation of alcohol sols of arsenic trisulphide, platinum and carbon by light is sensitised by anthracene, and it is suggested that it may be possible to use these colloids as indicators in the study of photochemical effects.—J. C. W.

Indicators: Application. J. L. Lizius and N. Evers. Analyst, 1922, **47**, 331-341.

A list of indicators for general use in the titration of acids and bases is suggested. The value of mixed indicators is discussed, and several which have been found useful are described. By titrating to a definite shade of colour, instead of to the colour-change of the indicator, an increase in the accuracy of titration results, and certain titrations are made possible which are impracticable by ordinary methods. A list of titrations is given with the indicators suggested for each. —J. C. W.

Lignin Methyl Ether: Oxidation. E. Heuser and S. Samuelsen. Cellulosechemie, 1922, **3**, 78-83.

The only definite product obtained hitherto in the oxidation of lignin or lignosulphonic acid is oxalic acid, which accords with the view that lignin is an aromatic hydroxyl derivative. With the hope of obtaining aromatic oxidation products, the oxidation of the methyl ethers has now been studied, but again only oxalic acid could be found. —J. C. W.

Microscopic Section; Staining——. F. M. McFarland. Science, 1922, **56**, 43-44.

The author describes some simplifications of microscopical technique. These include the substitution of acetone for the usual series of graded alcohols for the hydration and dehydration of sections, and methods for staining ribbons of sections without removing the paraffin in which the material was embedded. —J. C. W.

Oils and Fats; A Study of the Rate of Saponification of——by Aqueous Alkali under Various Conditions. M. H. Norris and J. W. McBain. Jl. Chem. Soc., 1922, **121**, 1362-1375.

When neutral oils are boiled with alkali the rate of saponification is at first negligible, then rapid, with abnormal retardation of the final stages, especially when alkali and oil are present in equivalent amount. Vigorous stirring increases the initial rate. With insufficient alkali to cause salting out, the rate is increased by increase in the concentration of alkali. The rate depends largely on the degree of emulsification. Salting out in itself diminishes the rate by at least one-half. Further addition of alkali increases the rate almost in direct proportion to the amount added. When the alkali is sufficient to cause salting-out, addition of salt retards the saponification. The temperature coefficient is less than 1·5, and the rate is less than proportional to the rate of stirring, showing that the observed saponification is largely governed by physical processes. A saponification may be completed within a few hours to the extent of 99·8%. In the experiments described much quicker saponification was effected than in soap-boiling practice in spite of neutralised oils, and alkali initially free from soap, having been employed. —J. C. W.

Cotton Fabric: Acidimetry. J. Beckering Vinckers. Mededeel. Rijksvoorlichtingsdienst Vezel., Delft, 1922, 26-27.

In a report on the tendering of sulphur-dyed cloth, reference is made to the difficulty of estimating traces of acid on a fabric. It is stated that 0·02% of sulphuric acid is sufficient to introduce a risk at ordinary temperatures or 0·002% at higher temperatures. The presence of less than 0·02% cannot be demonstrated by making an aqueous extract, but if the cloth is moistened, nearly dried and pressed on litmus paper with a hot iron the presence of 0·01% can be revealed. —J. C. W.

Cellulose: Fermentation. C. A. G. Charpentier. Abstr. Bacteriology (from Centralanstalten f. försoksväsendet 1920, Med. No. 205, and 1921, Med. No. 218), 1922, **6**, 182.

A method of estimating cellulose in soil is described, and is applied to study the effect of adding various manures to several different types of soils, at various moisture contents, on the cellulose-decomposing power of the soil. The effect of lime and ammonium sulphate were also studied. It was found that the decomposition of cellulose in the soil is hastened by ammonia, by the presence of plant nutrients and by moisture. The larger the amount of water that can be taken up by the soil without excluding air, the more quickly is cellulose destroyed.—J. C. W.

Starches; Detection of Foreign—in Flour. K. Amberger. Experiment Sta. Rec. (from Ztschr. Untersuch. Nahr. u. Genussmtl., 1921, **42**, 181, 182), 1922, **46**, 807.

The method depends on the principle that at a temperature not exceeding 60°C. wheat, rye, barley, and oat starches are hydrolysed by diastase, whilst corn, potato, and bean starches are unchanged, and when separated from the soluble matter by centrifugation can be detected under the microscope. —J. C. W.

Cellulose: Hydrolysis. P. P. Budnikow and P. W. Solotarew. Chem. Zentr. (from Ber. Polytechnikum Iwanowo-Wosniessensk, 1921, **4**, 119-128), 1922, iv, 324-325.

A review of the technical processes for the conversion of cellulose into fermentable sugars, dealing with difficulties of obtaining a concentrated solution of glucose and the recovery of the sulphuric acid employed. The authors treated Swedish filter paper with 72% sulphuric acid and diluted the solution until the concentration of sulphuric acid was not greater than 3%. The diluted solution was heated in an autoclave at 120° for 2 hrs., giving a 0·6% solution of glucose. This solution was neutralised with barium carbonate and used to dilute a second cellulose solution prepared as above. The process was repeated several times and, by subsequent fermentation of the glucose, the authors obtained a yield of 85% of the theoretical quantity of alcohol. A process for the recovery of the sulphuric acid electrolytically is described. —J. C. W.

Oxidase: Detection. R. Chodat and E. Rouge. Compt. rend., 1922, **175**, 252-255.

A method of localisation of an intracellular oxidase is described. Sections of etiolated shoots from potatoes were placed in an 8% solution of glucose for 5 mins., then transferred to a freshly prepared neutral solution of pyrogallol and arranged in a thin layer so that the air had access to all parts. A yellowing of the plastids with subsequent deposition of purpurogallin served to localise the oxidising ferment.—J. C. W.

Flour: Maturing. F. L. Dunlap. Chem. and Met. Eng., 1922, **27**, 174-177.

The chemical phases of the maturing of flour, in particular the action of chlorine, are described. Flour which has been submitted to the chlorine treatment is stabilized in the sense that its acidity remains constant at the optimum point for baking for many months. This is brought about by arresting the action of enzymes. Chlorine-treated flour is also much less readily subject to rancidity, mould and insect infestation. —J. C. W.

Potato Starch: Variations. E. Parow. Chem. Zentr. (from Z. f. Spiritusindustrie, 1922, **45**, 103, 111, 119, 127), 1922, iv, 169.

It is shown that large starch grains furnish a whiter, finer powdered starch than small grains. Potatoes which have a high starch content and are simultaneously rich in large grains furnish not only a high total yield of starch, but also the highest yield of superior quality starch powder. The quantity of large starch grains present depends on the kind of potato. With increasing maturity of the potato the starch grains increase in size. The proportions of different sizes of starch grains in various kinds of potatoes have been ascertained.
—J. C. W.

China Clay; Testing——. J. Strachan. Chem. Trade Jl., 1922, **70**, 660-661.

It is stated that, with regard to moisture, the 12% basis now frequently adopted is probably a fair figure in view of the loss in transport to which very dry clay would be subject. Suggestions are made for standardising the methods of estimation of grit and sand in China clay and tentative standards for the maximum permissible amounts of grit in various grades of clay are put forward. —J. C. W.

Potassium; Investigation of Atkinson's Process for the Estimation of——in Presence of Sodium, Magnesium, Sulphates and Phosphates. S. J. Watson. Analyst, 1922, **47**, 285-288.

The author estimated the potassium in mixtures containing known weights of potassium nitrate with known quantities of sodium sulphate and magnesium phosphate by the ordinary perchlorate method (Atkinson, *Analyst*, 1921, **46**, 354) and found that calculating to potassium nitrate there was an average loss of 5% calculated in the weight of potassium nitrate. The results may be brought more nearly to the actual by allowing for the solubility of the potassium perchlorate. Sulphate was detected to an appreciable extent in some of the perchlorate precipitates, but only a trace of phosphate was indicated.
—L. I. R. A.

Surface Tension; Rapid Determination of——. R. G. Green. Jl. Bact., 1922, **7**, 367-370.

An apparatus is described to which the name of a surface tension balance is given. This consists of three essential parts—a dropping pipette, a balance beam mounted on a torsion wire and an adjustable scale. The surface tension is determined by the drop method and is read off directly on a calibrated scale which indicates the torsion produced in a steel wire. —L. I. R. A.

Fats: Micro-Analysis. H. Lührig. Chem. Zentr. (from Pharm. Zentralhalle, 1922, **63**, 218-221), 1922, iv, 327.

The usual macro-chemical methods for the determination of the Reichert-Meissl and Polenske numbers in the examination of butter fats are sufficiently accurate if they are employed as half-microchemical methods, or as microchemical methods if the average values obtained are multiplied by a factor. The microchemical determination of the saponification number also gives satisfactory results, but the Hübl method for the determination of the iodine number cannot be carried out microchemically. —J. C. W.

Soxhlet Apparatus; Extraction of Small Quantities of Liquids in a——. H. Handorf. Z. angew. Chem., 1922, **35**, 257-258.

The liquid to be extracted is placed in the inner tube. If the liquid is extracted by a solvent lighter than itself, the condensed solvent drops into the funnel and rises in drops from the rose through the liquid. If the liquid is extracted by a solvent heavier than itself, a short funnel ending in a capillary rests on the top of the tube and the condensed solvent falls through the liquid and rises in the inner tube. The apparatus is suited for the extraction of liquids containing colloidal substances.
—L. I. R. A.

Chlorine; Determination of Free——and Hypochlorous Acid in Concentrated Salt Solutions. M. C. Taylor and C. A. Gammal. Jl. Ind. Eng. Chem., 1922, **14**, 632-635.

The estimation depends upon the rate of removal of the free chlorine following a linear law, whereas that liberated by decompositions in solution is removed according to order of these changes, which in this case are bimolecular. The author claims that free chlorine, hydrochloric acid and hypochlorous acid and sodium hypochlorite may be accurately determined.
—L. I. R. A.

Tallow for Textile Industries; Preparation and Choice of——. H. Contaut. L'Avenir Text., 1922, **4**, 424-427.

An account of the composition of various tallows is given and a method of determining the solidifying point of the corresponding fatty acids is described. The detection and approximate estimation of impurities are referred to, and a description is given of several processes for preparing tallows.
—L. I. R. A.

A Study of Flax and Kindred Fibres. See This *Jl.* (Trans.), 1922, **13**, 161.

Some Physical Quantities of Mule Yarns. See This *Jl.* (Trans.), 1922, **13**, 172.

Artificial Silk and its Applications in the Textile Industry. See This *Jl.* (Proc.), 1922, **13**, 145.

7.—BUILDING AND POWER.

(C)—POWER.

Electrical Layout in Cotton Mill. W. S. Maddocks. Electrical World, 1922, **80**, 323.

In the mill in question the usual order of the departments has been reversed, the blowing room being on the top floor and the cotton gradually descending through the various procesess down to the ground floor. Power is supplied by the Lowell Electric Light Corporation, and is transformed down from 13,200 volts to 600 volts. The artificial lighting is almost entirely by 100 watt lamps mounted 10½ ft. high; a table of lamp spacings and light intensities is given. Individual driving is installed in the blowing room and ring spinning rooms and group driving elsewhere. Attention is drawn to several special features of the cabling system. —V. M.

Electric Power in the Factory; The Use and Advantages of——as Illustrated by its Application to the Jute Industry. J. F. Crowley. Jl. Roy. Soc. Arts, 1922, **70**, 663-698.

The question of power supply is dealt with and the factors which determine the choice between purchase of power from an outside source and the generation of power at the mill are stated; the steam turbine is shown to meet the power requirements better than other prime movers by virtue of its uniform speed. The application of power is discussed from the point of view of buildings, manufacturing processes, cost and production; the serious effect of cyclic irregularity in speed is stressed. The success of electrical driving depends upon the manner of its application and demands an exact knowledge of the requirements of the industry and its manufacturing processes. Jute manufacturing processes are briefly described and their power requirements stated. It is shown how electricity best meets the driving criteria laid down, its real advantage lying in the increased production which it makes possible; it is specially noted that any increase in production results in a far more than proportionate increase in profits. —V. M

Ball and Roller Bearings and their Application to Textile Machinery. See This *Jl.* (Proc.), 1922, **13**, 151.

PATENTS.

Lubricant. L. Minton, Manchester. E.P. 179,344, 11/5/22.

A lubricant for yarns and fibrous material, as well as for machines employed for weaving such materials, is composed of a mixture of powdered mica and one or more metals, in the form of powder, having lubricating properties similar to those of aluminium, such as tin, zinc, copper, silver and platinum. Suitable proportions are equal parts of mica and metal. The mixture may be used dry or combined with an oleaginous base, such as tallow, soap, etc., to form a paste. —J. C. W.

9.—COMMERCE, ECONOMICS, LABOUR, ORGANISATION, COSTING, &c.

Argentina: Wool Production and Export. Bd. of Trade Jl., 1922, **109**, 133.

For a series of years the stock of sheep in Argentina has been diminishing except in the far South territories (Patagonia), where it continues to increase. The wool most produced is coarse, of low counts up to 46's. The province of Buenos Aires produces mainly coarse wools of the Lincoln type, the fleeces averaging 7-8lb. each. Wools from the farther West, the Central Pampa and the provinces of Entre Rios and Corrientes are lighter and of finer fibre, but the "Pampa Central" wools are less marketable, owing to their earthy colour and the amount of earth and dust in the fleece. Germany is regaining her pre-war position as a user of Argentine wool. —L. M. S.

Greece: Cottons, Silks and Woollens in 1921. Bd. of Trade Jl., 1922, **109**, 217.

In his recent Report on the Industrial and Economic Situation in Greece, the Commercial Secretary to H.M. Legation at Athens states that the textile industry now takes a place of first importance and includes the manufacture of fabrics in cotton, wool, silk, hemp and jute. The total horse-power employed is estimated at 11,119. There are 75 cotton spinning factories, 14 silk spinning works and about 30 factories belonging to the woollen industry. Approximately 11,000 workpeople are employed in the textile industry. —L. M. S.

New State of Latvia: Exporter of Flax to Ulster. Belfast Telegraph, 1922, Aug. 26, 5.

The new State of Latvia is the natural gateway of Russian trade into Western Europe. In the days of Imperial Russia one-third of her export and one-fifth of her import trade passed through this gateway. The majority of goods imported in Latvia consists of machinery and textiles, goods which can be procured better in Great Britain, by virtue of superior quality, than in any other country. The exports consist mainly of flax and linseed. Free trade has been restored in the case of many other monopolies—it is only a matter of time and the flax trade will follow suit, enabling private enterprise to compete in the market, with an anticipated considerable expansion in the export of flax and seed. —F. B.

Active and Idle Machinery in Wool Manufacture in U.S.A. Bull. Nat. Assoc. Wool Mfrs., 1922, **52**, 407.

The report prepared by the Bureau of the census for the second quarter of 1922. —L. M. S.

Canada: Asbestos. Bd. of Trade Jl., 1922, **109**, 206.

The mining and marketing of asbestos in 1921 declined to less than half the activity of the preceding year. Trading in asbestos was almost at a standstill throughout the year, and as a consequence the demand for this product was very slight. Operations were continued at some of the mines throughout the year, but generally conditions were very dull. One of the principal difficulties confronting Canadian producers is the profitable disposal of low-grade product. The spinning fibre, for which there is a constant demand, represents only a very small proportion of the entire output, and ways and means have yet to be devised to find profitable markets for the large quantities of the low-grade material produced by the normal processes of working. —L. M. S.

Linen Industry in France; Reorganisation of the——. L. Le Barbier. L'Avenir Text., 1922, **4**, No.8, 8-16.

Report of an address given to representatives of all the French Linen Industry Syndicates at their second monthly reunion, May 2nd, 1922. The question of securing improved flax production was dealt with at some length, the culture, retting and scutching of flax being discussed mainly from the point of view of co-operation and organisation. —L. I. R. A.

Czecho-Slovakia: Textile Industries in 1921-22. Bd. of Trade Jl., 1922, **109**, 185.

During the past year the situation in the textile industry has undergone a complete change from that immediately following the end of the war. In 1921 most of the cotton factories were only working at about 50% of their capacity; the rapid rise of the Czech crown towards the end of 1921 and the beginning of this year made it impossible for Jugo-Slavia, Hungary, Austria and Poland to buy goods in Czecho-Slovakia, and this led to a crisis in the cotton trade. Flax and flax yarns, which hitherto had been under State control, were decontrolled in the autumn of 1921, resulting in an immediate rise of 200-300% in the price of flax, which naturally did not lead to an improvement in the market. Owing to the excessive heat of last summer the present flax harvest is not only bad as far as quantity is concerned, but the quality is also very inferior. The wool industry showed a marked improvement during the past year. The imports and exports of cotton goods and yarns, flax, hemp, jute and yarns, woollen goods and yarns, silk and silk goods are given. —L. M. S.

Textiles: U.S.A. Bd. of Trade Jl., 1922, **109**, 267.

The quantity of cotton cloths exported from the U.S. in the year ended June 30 was 613 million yds., against 556 million yds. in the immediately preceding year. This increase in the quantity exported in 1922 occurs, states the "Trade Record" of the National City Bank of New York, especially in the Orient. China alone took over 30 million yds., against 12 in the preceding year, and the Philippines 87 million yds., against 43 a year earlier. To Asia and Oceania as a whole the exports were 162 million yds., against 96 in the preceding year. To Europe the total was 40 million yds., against 20 last year, and to S. America 115 million yds., against 124 in 1920-21. Shipments to Cuba were but 30 million yds., against approximately 90 in the previous year. —L. M. S.

Indian Cotton in Spain. Times Trade Supp., 1922, **10**, 526.

Reports from the mills in Barcelona which have used a trial consignment of Indian cotton are distinctly favourable. The long staple has been found admirable for local use, and the importer who brought in the shipment as an experiment predicts a signal success for the future of this product in Spain. —L. M. S.

B.A.W.R.A. Wool: Stocks and Disposals. Bd. of Trade Jl., 1922, **109**, 217.

Stocks Dec. 31, 1922, and disposals Jan.-July, 1922. —L. M. S.

Health in the Factory: The Bournville Scheme. See This *Jl.* (Proc.), 1922, **13**, 156.

Wool Growing in the United States: Tariff and Effect on Sheep Breeding. See Section 1B.

10.—MISCELLANEOUS.

Maize Stalks, Flowers and Leaves; Utiliz
tion of——. J. Burtt-Davy. S. Africa
Jl. Ind., 1922, **5**, 357-364.

The pithy mass inside the maize stal
furnishes a nearly pure "natur
cellulose"; in the U.S.A. this pith i
extracted by machinery and is used in th
manufacture of celluloid, paper pulp,
floor covering resembling linoleum, viscos
nitrates, etc. The husks or spathes enclos
ing the ears of maize are stated to hav
been used in Austria as a fibre for yarn
to be used as a substitute for flax in crasl
and for paper making. —L. M. S

ABSTRACTS

I.—FIBRES AND THEIR PRODUCTION.

(B)—ANIMAL.

Italian Raw Silk Sources. Amer. Silk Jl., 1922, **41**, 72.

It is now hoped that there will be a revival of the home supply. Chinese seed is preferred to Japanese; mulberry plantations are being renewed. The Near East cultivators cannot cope with the Italian demand. —F. G. P.

Sheep; New Type of——. Wool Rec., 1922, **22**, 776.

A new type of sheep, the result of a cross between the Lincoln and the Rambouillet, and which is called the Columbia, has been produced by the United States Department of Agriculture. The crossing experiments were begun in 1912, and it is stated that mature rams then averaged 200 lb. to 250 lb. in weight and ewes from 125 lb. to 150 lb. In 1920 the average weight per head of the fleece was 10 lb., and the quality was three-eighths and one-quarter blood combing. —L. M. S.

Madagascar Wool. Times Trade Supp., 1922, **11**, 30.

Roubaix industrialists are actively pursuing an officially supported plan to make Madagascar a national sheep breeding centre. The Ministry for the Colonies has now appointed a representative to buy S. African merinos to be taken to selected Madagascan pastures. Similar experiments, though on a smaller scale, are to be made in the French Sudan.—L. M. S.

Wool Industry of China. Jl. Roy. Soc. Arts, 1922, **70**, 781.

Many varieties of sheep's wool are produced, but the wool generally is of poor quality because the Chinese have not adopted modern scientific methods of breeding and management. Mongolia and Manchuria offer wide fields for development of the wool industry. Improvements in breeding and management have already been undertaken in Hunan and Manchuria, and a cleaning factory established in Tientsin has greatly increased the exports. As a result of experiments made by the South Manchuria Railway Co. a crossbred between the merino sheep imported from abroad and the native Mongolian sheep has resulted in the production of wool of twice the quality and quantity on individual sheep. Sheep's wool from Tibet, while of better quality than that from Mongolia or Manchuria, compares unfavourably in price because of high transportation charges. —L. M. S.

Germans to Develop Raw Silk. Amer. Silk Jl., 1922, **41**, 72.

It has been found possible to grow silk profitably as an industry for disabled soldiers. —F. G. P.

B.A.W.R.A. Wool: Stocks and Disposals. See Section 9.

A Field for the Inventor: [Crossbred Wools]. See This *Jl.* (Proc.), 1922, **13**, 161.

Department of Agriculture, Punjab. See This *Jl.* (Proc.), 1922, **13**, 164.

Department of Agriculture, Madras. See This *Jl.* (Proc.), 1922, **13**, 164.

(C)—VEGETABLE.

Fibrous Plants of Mexico. J. M. Bracho. Fibre and Fabric, 1922, **75**, Nos. 1960-1961, 21, 13.

Notes are given on Yucatan sisal or henequen, "ixtle," "zacaton" or broom root, "lechuguilla" and "pita" fibre. The fibre industry in Mexico is so small that not even the domestic needs are covered; jute bags have to be imported for transportation purposes, though ixtle bags are just as good or better. At least 35 known varieties of the *Agave Americana* exist. The main drawback to the progress of the industry is the difficulty in obtaining the right kind of machinery for shredding the fibre. —L. M. S.

Insect Pests; Destruction of——. Chem. Trade Jl., 1922, **71**, 420.

A product has recently been placed upon the market which, unlike calcium arsenate, can be applied to the growing cotton plant under any weather conditions and does not require to be brought into solution before it exerts its effects. Trials are being made with the substance in the United States, and it is claimed that the product (which has already found extensive application in this country as a general insect exterminator under the trade name of "Exterpest") is also efficacious against the pink boll worm and the cut worm of the Egyptian and Indian cotton fields. —L. M. S.

Egypt: Area Sown to Cotton in 1921-22. Bd. of Trade Jl., 1922, **109**, 323.

Official statistics of the area under different varieties of cotton during the agricultural years ending 31st August, 1921 and 1922. The proportion borne by Sakellaridis to the total area is slightly more than 77% in 1920-21 and slightly less than this percentage in 1921-22. —L. M. S.

Sea Island Cotton in Dutch Guiana; Production of——. U.S. Comm. Rpts., 1922, Sept. 4, 648.

Extensive experiments have shown that this variety of cotton yields more per acre in that region of S. America than in the United States, as the following advantages obtain in Dutch Guiana:—Cheap land and cheap labour; no fertilizer needed because of the natural richness of the soil; no insect pests; two harvests can be had each year; cheap water transportation to the harbour. —L. M. S.

Cotton in East Africa. Fibre and Fabric, 1922, **75**, No.1964, 25.

Cotton is being cultivated in the Italian colony of Benedir in E. Africa, and the first shipment of about 1,000 tons will probably be made to Italy during 1923. The grade is reported to be superior to that of Egpytian cotton, and it is estimated that within three years the annual production will reach 3,000 tons. —L. M. S.

Cotton Cultivation in N.E. Brazil; Possibilities of——. I. Albano. Report, 11th International Cotton Congress, 1922, 151-164.

The north-east of Brazil is able to produce good long-staple cotton, and the valley of the Jaguaribe can produce cotton superior to Sea Island as soon as up-to-date appliances are introduced. Capital and scientific direction are now required. —B. C. I. R. A.

Egyptian Cotton Crop from 1898 to 1921. W. L. Balls. Report, 11th International Cotton Congress, 1922, 188-197.

The author traces the history of the Egyptian crop as shown by statistics of arrivals of cotton at Alexandria, and indicates how they can be used to throw light on the actual behaviour of the crop in the fields. The importance of various factors in causing the depreciation of the yield of Egyptian cotton are also approximately evaluated. The chief of these is to be sought in the soil water conditions. A less important effect is due to pink boll worms. Social disturbances have also affected the crop. —B. C. I. R. A.

The Indian Central Cotton Committee. B. C. Burt. Report, 11th International Cotton Congress, 1922, 203-207.

A report on the committee's work. —B. C. I. R. A.

Cotton Cultivation in the British Colonies. J. M. Thomas. Report, 11th International Cotton Congress, 1922, 164-175.

An outline of the possibilities and prospects in Uganda, The Sudan, Nigeria, West Indies, Nyasaland, South Africa and Rhodesia, Australia, Tanganyika Territory, Kenya Colony, Mesopotamia and India. —B. C. I. R. A.

Cotton Growing in Italian Somaliland. Report, 11th International Cotton Congress, 1922, 207-208.

A report on the possibilities of cotton cultivation. It is stated that the country is very fertile, but the construction of extensive irrigation works is required. —B. C. I. R. A.

French Colonial Cotton Growing Association. Noguès. Report, 11th International Cotton Congress, 1922, 198-203.

An outline of the prospects of cotton cultivation in the French colonies, especially French West Africa and Indo-China. —B. C. I. R. A.

Cotton Growing in the Congo. R. Mees. Report, 11th International Cotton Congress, 1922, 149-150.

The districts suitable for cotton growing, as regards climate and soil, are, south of the equator, Sankuru, Lomani, Kasai and Maniema, and, north of the equator, the Lower and Upper Uélé. The rainy seasons are exactly opposite to each other north and south of the equator, and thus it is possible to have cotton crops during the whole of the year. The American variety, "Upland Big Boll," was found to be the best suited to the climate. Its staple is 28 to 30 mms., and it corresponds more or less to fully good middling. —B. C. I. R. A.

Egypt: Cotton Pest. F. C. Willcocks. Sultanic Agric. Soc., Bull. No.1, 1922, 5-38.

A complete survey of the more important insects and mites which feed on cotton in Egypt. —B. C. I. R. A.

Cotton Wilt: Control. L. E. Rast. Jl. Agronomy, 1922, **14**, 222-224.

Field experiments are described which have led the author to believe that cotton wilt may be controlled by the application of commercial fertilisers containing potash. Kainite was used. The author is unable to explain the action of the potash. —B. C. I. R. A.

Hemp Stalks as a Raw Material for Paper Manufacture. E. Rassow and A. Zschenderlein. Z. angew. Chem., 1921, **34**, 204-206.

A chemical study dealing with the use of hemp stalks as a cellulosic raw material. Analysis of two samples of hemp fibre gave following percentage composition of dry matter:—Ash, 1·25, 1·51; fats and resins, 2·85, 4·26; furfurol, 14·18, 14·37; pentosans (including those of the crude fibre), 40·57, 40·43; lignin, 23·33, 22·08. Hemp fibres heated for 12-13 hrs. at 140° to 150° with 4% sulphate yields a paper pulp which bleaches well and is of good appearance and contains 93-94% crude cellulose with 10% pentosans. Flax is found to have smaller pure cellulose content than hemp. Author suggests pentosans as intermediate products in the natural synthesis of lignin. —L. I. R. A.

Cotton Growing in Spain. Report, 11th International Cotton Congress, 1922, 208-212.

A report of the "Fomento Trabajo Nacional" states that all the regions of the Guadiana up to the province of Barcelona possess the necessary climatic conditions for cotton growing, and cotton is grown in the provinces of Castellon, Tarragona, Barcelona, and the Balearic Islands. The cotton produced is comparable with cotton from California, of fully good middling grade, and length of fibre 28-29 mms. —B. C. I. R. A.

Cotton Cultivation in China. U. L. Sun. Report, 11th International Cotton Congress, 1922, 183-187.

A summary of work done by the joint activities of the Chinese Cotton Millowners' Association and the South-Eastern University for the improvement of cultivation. —B. C. I. R. A.

Flax Hybrids; Experiments on——. L. Blaringhem. Compt. rend., 1921, **173**, 329-331.

Linseed types of flax are much more homogeneous than fibre varieties; therefore, the authors worked with a white-seeded flax and a Morocco flax. It was found to be difficult to make crosses, but in the first generation the Moroccan characters were found to be predominant. Taking all six of the crosses, the figures did not give a Mendelian ratio for colour of seed and ciliation of septa, but when only three crosses were taken into account the author found (1) brown seed colour of the Moroccan flax to be dominant to the white of white-seeded variety, (2) ciliate septa to be dominant to non-ciliate septa. —L. I. R. A.

Plant: Wilting. R. C. Knight. Annals of Botany, 1922, **36**, 361-383.

The author has studied the phenomenon of wilting in its relation to environmental conditions of soil and atmosphere, and records some observations on the transpiration, stomatal aperture, and leaf water-content of wilting plants. It is shown that in the early stages of wilting, the stomata open wider and the rate of transpiration increases. These factors are not correlated with the temperature of the air. The attainment of the maxima of transpiration rate and stomatal aperture represents definite stages in the wilting process, which are reached before the water content of the wilting leaf has fallen more than about 1%. The leaf appears flaccid before a definite decrease in water content can be determined by experiment, which indicates that the wall of a normally turgid cell is only slightly distended. A simple atmometer for determining the evaporating power of the air in a greenhouse and a recording porometer for determining stomatal openings are described. —B. C. I. R. A.

Cotton Boll-worm: Control. O. Schreiner. Chem. Zentr. (from Amer. Fertilizer, 1922, **56**, 122c-122e), 1922, **iii**, 687.

The author considers the advisability of manuring cotton plants attacked by the cotton worm. Manuring with phosphates may cause the cotton to mature so early that it is possible to pick it before any great damage is inflicted. Nitrogenous fertilisers increase the total crop. —B. C. I. R. A.

Cotton Growing in U.S.A. W. Whittam. Canad. Text. Jl., 1922, **39**, 343-344.

The author shows that the cost of production of American cotton is governed by land fertility, insect depredations, use, cost and composition of fertilisers, and many other variable factors which make it impossible for all growers to receive a reasonable profit. The distribution of costs on 842 farms located in 10 representative counties is roughly—Labour, 65·3%; materials, 9·3%; ginning, 2·9%; other items, 22·5%. Actual money values based on these factors indicate that the great need of the farmer is to increase the yield per acre per man. —B. C. I. R. A.

Boll Weevil: Control. Chem. & Met. Eng., 1922, **27**, 567.

Experiments on dusting cotton fields with calcium arsenate from an aeroplane have proved very successful. It is possible to poison 20 acres per hr. in a much more thorough manner than could be done by the ground equipment, and the amount of material needed per acre is reduced one-half. Community poisoning is to be undertaken at once in many districts, and the whole region will be covered, thereby preventing migration of the weevil from unpoisoned tracts. —B. C. I. R. A.

Cotton Cultivation in Peru. Text. Merc., 1922, **67**, 205.

The possibilities of development in production are said to be extensive. The country possesses an ideal climate, is entirely free from boll-weevil, and furnishes a high yield per acre. Many varieties of cotton are grown in localised areas, and a special feature of the region is the "full rough" which is grown exclusively in plantations close to the sea. —B. C. I. R. A.

A Study of Flax and Kindred Fibres. II.—Further Observations on Flax (and Cotton) Fibres. Probable Relationship between "Stomata" and "Slow Spirals" of Cotton and "Dislocation Marks" of Flax. See This *Jl.* (Trans.), 1922, **13**, 213.

Roumania: Cotton Textile Industry and Hemp Cultivation. See Section 9.

Department of Agriculture, Madras. See This *Jl.* (Proc.), 1922, **13**, 164.

Agricultural Department, Assam. See This *Jl.* (Proc.), 1922, **13**, 164.

Department of Agriculture, Punjab. See This *Jl.* (Proc.), 1922, **13**, 164.

International Cotton Bulletin. See This *Jl.* (Proc.), 1922, **13**, 163.

The Linen Industry Research Institute. See This *Jl.* (Proc.), 1922, **13**, 162.

(D)—ARTIFICIAL.

Viscose Silk; Preparation and Dyeing of—. H. Verdier. Assoc. Chim. l'Ind. Text., Rev. Mensuelle (from La Revue des Produits Chimiques, 1922, Aug. 15), 1922, **12**, 172.

A general article on the preparation, washing, drying and dyeing and properties of the fibres. —L. M. S.

Viscose: Manufacture. E. Wurtz. Deuts. Faserstoffe, 1922, **4**, 100-102.

A general discussion of the most suitable construction and dimensions for the sulphide room in the viscose process of artificial silk manufacture.—B. C. I. R. A.

Artificial Silk: Manufacture. A. Lehne. Deuts. Faserstoffe, 1922, **4**, 73-78.

A lecture and discussion on the development of the artificial silk and staple fibre industry. —B. C. I. R. A.

Artificial Silk; Tendering of——. See Section 6.

The Alkali Resinates and their Applications. See Section 10.

PATENTS.

Scutching and Swinging of Flax and Hemp. Vertongen. F.P.525,568; Appl., 9/9/20.

The raw material is first conducted between two feeding rollers by means of an endless table, then through several decorticating or breaking rollers, and finally through scutching rollers having an oscillating motion. The fibres are taken away by a clearing and shaking table. —Bur. Text.

Viscose Artificial Silk; Plastic Compositions. Plauson's (Parent Co.), Ltd., London. E.P.184,533, 11/8/22.

Viscose is prepared from cellulose rendered colloidal by high-speed mechanical disintegration, as by grinding in mill as in Spec. 179,214, in the presence of a liquid dispersion medium, preferably a solution of caustic soda; to the alkali-cellulose so obtained, carbon bisulphide is added and the reaction continued in the same apparatus with vigorous beating. Ripening of the viscose is claimed to be either unnecessary or, in the case of artificial silk, may be reduced to a few hours. Plastic masses are obtained by heating to 80-100°C. —A.

Cellulose Esters; Artificial Threads, etc. J. Duclaux, Paris. E.P.184,197, 1/8/22.

To obtain non-tarnished films and threads, capable of taking a dye, from cellulose nitrate, acetate, butyrate and other esters, there is added to a solution of the ester in a relatively organic solvent a small quantity of a non-volatile organic solvent soluble in water, and after forming the thread or film by the evaporation of the volatile solvent, the non-volatile solvent is extracted by washing with water. —A.

Artificial Silk: Viscose. H. Dreyfus, London. E.P.183,882, 9/8/22.

To avoid the necessity for the ripening process and to obtain directly a high molecular product, cellulose (or a near conversion product) associated with caustic alkali in a concentration of 15% and upwards, is treated with carbon disulphide in a quantity of not more than one-half molecule per molecule of cellulose. The treatment with the reduced proportion of carbon disulphide is conveniently carried out in the presence of benzol or other solvent or diluent for carbon disulphide. —A.

2.—CONVERSION OF FIBRES INTO FINISHED YARNS.

(B)—SPINNING AND DOUBLING.

France; Use of Long Drafts in——. Text. Rec., 1922, **40**, No.474, 42.

Many French and Belgian spinners of medium counts have adopted the principle of long drafts (Casablancas, Janninck, or Palazzo systems), with reduction in cost of production. It is stated that the quality of yarn obtained is quite satisfactory, and it is suggested that English spinners should examine the question of long drafts impartially instead of condemning the principle because it conflicts with present notions. —B. C. I. R. A.

Cap Frames; Mechanical Doffer for——. Text. Rec., 1922, **40**, No.474, 53-54.

A mechanical appliance is described which removes the full bobbin and substitutes an empty one on the spindle. It can be fitted to any standard make of frame. A doffing carriage carries a doffing peg, a thread placer, and a box containing the empty bobbin. The carriage is fixed on racks which are moved by handles attached to rack wheels. The cap is drawn back by a travelling cap holder which passes under the cap toe. The full bobbin is conveyed behind the spindle in a spring clip, which is carried on a swivelled rod. The doffing carriage is then raised and the empty bobbin placed on the spindle. The full bobbin is brought into a vertical position below the empty one and the cap replaced, leaving the thread in the path of the wharle. —L. I. R. A.

Paper Yarn; Spinning——. T. Woodhouse. Text. Rec., 1922, **40**, 41-42.

An illustrated account of the dry method of spinning paper yarns and suggestions for their use. —B. C. I. R. A.

Snarly Mule Yarns: Causes. See Section 2D.

(D)—YARNS AND CORDS.

Eclipse Yarn Cleaner. Text. World, 1922, **62**, 1681.

It is claimed for this automatic cleaner that it produces thoroughly clean yarn, free from dirt, sand, slugs, bunches, and all foreign matter. This is accomplished by means of constantly vibrating flexible blades. The cleaner can be attached to any make of winder or spooler. The strength or elasticity of the yarn is not affected by the use of this device. —B. C. I. R. A.

Yarn Numbering. E. Möller. Spinner u. Weber, 1922, **40**, Nos.31-33.

Deals with the numbering and reeling of cotton yarns, "Eisengarn," double "Eisengarn," Vigogne and imitation yarns, flax, jute, ramie and paper yarns and of artificial silk, carded woollen yarns, worsted, mungo, shoddy, alpaca, Schappe and pure silk yarns, metal threads and spun yarns in Great Britain, France, Austria and Germany. Yarn numbering in the different countries is illustrated graphically. —L. M. S.

Braided Cord; Manufacture of——. H. D. Martin. Canad. Text. Jl., 1922, **39**, 339-340.

In a general account of manufacture and uses, it is stated that short staple cottons are more suitable than long varieties. It is suggested that this is due to the excessive amount of bending which the hairs undergo, the shorter staples suffering less damage. —B. C. I. R. A.

Snarly Mule Yarns: Causes. Text. Mfr., 1922, **48**, 239-240.

Snarls can usually be ascribed to faulty setting of various parts of the mule mechanism, and these causes are reviewed in detail. —B. C. I. R. A.

Paper Yarn; Spinning——. See Section 2B.

Knitting Yarn: Mercerisation. See Section 4H.

PATENTS.

Spinning: Spindle. Bezold and Glafey, Berlin. E.P.184,488; Conv., 12/8/21.

Relates to construction of a spinning spindle in which the bearings (either plain or ball), accommodated in a closed-ended shell, are arranged on a fixed spindle non-rotatably mounted in the spindle rail.—A.

Improvements to Crossed Bobbin-Winding Frame. Joannès Verrière. F.P.527,804; Appl., 1/12/20.

A supplementary cylinder is put between the ordinary cylinder of the spindle and the bobbin on which the yarn is wound. This cylinder is used as an intermediate organ for receiving directly the yarn at delivery from its ordinary guide and for delivering it afterwards to the bobbin which turns at its contact. This cylinder turns on contact with the ordinary cylinder of the spindle. The yarn, on leaving the guide, accomplishes only a fraction of a turn on the intermediate cylinder. The width of this cylinder is always superior to the length of course of yarn and its surface does not cause displacement of the yarn. —Bur. Text.

Drafting for Worsted-Wool Spinning Mills. A. Schmitt. F.P.527,900; Appl., 4/12/20.

A roller of pinching and sliding is interposed between the circular comb and the drafting roller (which has a greater diameter than is usual), with its top roller, in contact with the drafting roller. The comb having an auxiliary has not a principal function during drafting; the pins need not be placed so close and need not be so strong as usual. —Bur. Text.

Jannink High Draft Mechanism. J. F. Jannink. G.P.352,830. Leipzig. Monats. Text. Ind., 1922, **37**, 129.

A roller drawing mechanism is described in which a pair of rollers of small diameter is so placed between the front and back rollers that their distance from the drawing rollers is less than the average staple length of the fibre. The upper roller is of smaller diameter than the lower roller and the distance between its centre and that of the drawing rollers is less than the distance between the centre of the lower roller and the drawing rollers. A light roller placed above these rollers causes them to exert a light pressure on the fibres so that they are drawn through without being torn. The device increases the drawing effect of the ordinary rollers very considerably. —B. C. I. R. A.

Driving the Draw of the Carriage and Rollers in Self-acting Mules. Soc. Alsacienne de Constructions mecaniques Belfort. F.P.524,543; Appl., 4/2/20.

The driving of the carriage and of the rollers in self-acting mules in which the tin rollers driving the spindles are set in motion by a differential motion and of which the main shaft has a continuous rotary motion is accomplished by working the shaft driving the cylinder and the back shaft by the draw of the carriage by means of an intermediate transmission, either through a shaft moved by the differential which drives the spindles or by an organ of the differential motion, the braking of which gives the spindles their speed. —Bur. Text.

Winding Machines; Improvements in——. Malassin and Justin. F.P.524,536; Appl., 6/5/20.

The alternate motion of the rod bearing the thread-guide is obtained by means of a cam with helicoidal groove in which is engaged a bowl fixed to the rod. The rotation of the bowl is assured by a train of gears driven by the main shaft. The yarn passes through the thread-guide without threading. —Bur. Text.

Artificial Threads; Films; Viscose. A. Kämpf, Premnitz, Germany. E.P. 184,449 and 184,450; Conv., 6/9/21,

A spinning bath for the viscose process consists of an aqueous solution of the acids obtained by sulphonating the condensation products prepared by reacting with phenols or aldehydes and ketones—or by reacting with phenols on wood in the presence of acid catalysts. Satisfactory results are claimed with unripened viscose. —A.

Combing Machine for Textile Fibres. A. E. Meyer, White Plains, New York. U.S.P.1,429,519, 19/9/22; Appl., 29/8/18, renewed 24/2/22.

Includes the provision of a combing cylinder which yields about its axis when the tension is such as would unnecessarily cut or break the fibres. —A.

Spinning; Mule——. H. S. Golland, Eccles. E.P.184,386, 17/8/22.

Refers to devices in an arrangement of the kind described in Spec. 1470/14 for producing cross-wound cops in mules. —A.

Spinning: Doffing Arrangements. Messrs. Wademan, Keighley. E.P.183,869, 28/7/22.

Doffing apparatus for spinning, twisting, slubbing, roving and like machines. The caps are gapped to engage the holders, and the gap prevents creation of air pressure in the cap and thereby tends to prevent fluffing of yarn. —A.

Manufacturing Artificial Silk. J. Clayton, Babbacombe, England (to Viscose Co., U.S.A.). U.S.P.1,429,127, 12/9/22; Appl., 6/11/19.

Refers to apparatus for spinning. —A.

Combing Machine. J. W. Nasmith, Manchester. U.S.P.1,430,023, 26/9/22; Appl., 9/4/21.

Cotton Combing Machine. W. Cordwell and D. Barker, Manchester. U.S.P. 1,430,286, 26/9/22; Appl., 4/6/20.

3.—CONVERSION OF YARNS INTO FABRICS.

C)—WEAVING.

Loom: Mechanism. Text. World, 1922, **62,** 765-769 and 883.

A general account of weaving machinery, discussing the mechanism of various types of looms, with illustrations.—B. C. I. R. A.

Tyre Fabric Loom. Text. World, 1922, **62**, 585.

An illustrated description of a cord tyre fabric loom (see U.S.P.1,421,081, This *Jl.* Abs., 1922, **13**, 202) for weaving the fabric tighter in the middle than at the selvedges. —B. C. I. R. A.

Coloured Fabrics; Weaving—. W. Ostwald. Chem. Abstr. (from Umschau, 1922, **26**, 321-323), 1922, **16**, 2609.

The methods of obtaining different shades by weaving variously coloured threads in different proportions are described. —B. C. I. R. A.

(D)—KNITTING.

Knitting Yarns: Mercerisation. See Section 4H.

PATENTS.

Automatic Loom. Société Saint fréres. F.P.527,941; Appl., 6/12/20.

A device for automatically changing the shuttle without stopping the loom when the weft yarn is broken comprises a turning-box with four beds mounted on the slay instead of the shuttle box. In the normal motion of the loom the upper bed is used as a shuttle box and the bed before the weaver contains a spare shuttle. When the yarn is broken or finished the turning-box turns a quarter of a turn, the spare shuttle takes the place of the working shuttle which is ejected. A weft fork moves the turning-box and a device is provided which avoids a falling pick during the changing of shuttle. —Bur. Text.

Weaving Cloth for Tyres. A. Darche. F.P.527,566; Appl., 12/11/20.

Refers to weaving of circular bands having "circumferential yarns" as warp and "radial" yarns as weft. This result is obtained by weaving warp yarns of various length, reeling off at linear unequal speeds in the loom. The warp yarns and afterwards the cloth are wound around cylinders having a dressed form and a variable diameter. The warp and weft yarns are superposed, except on each side, a narrow band constituting a list in which the yarns are woven in plain ordinary cloth. The weft yarns in the middle part of the cloth are free and can be crossed above and under the warp yarns. —Bur. Text.

Loom. E. J. Wilson (to F. C. Huyck and Sons, New York). U.S.P.1,428,572, 12/9/22; Appl., 23/5/21.

A loom having, in combination, a lay, picking mechanism at each end of the lay including a picker stick, electro-magnetic means for controlling the operation of each picking mechanism by a shuttle at the opposite end of the lay. —A.

Looms; Improvements to Beams of——. Cordola, Corne and de Montangon. F.P.523,764; Appl., 9/9/20.
Movable collars on the ends of the shaft of the beam are joined to the shaft by a system of bolt and click and ratchet wheel with a rack disposed to be opposed to the removings of forces applied to the ends of the beam. The bolt can be unlocked to permit the displacing and regulation of the collars by means of pressure on the outstanding end of the rods. —Bur. Text.

Registering Apparatus for Loom Production. Comptoir de l'industrie Linière à Paris. F.P.526,057; Appl., 15/10/20.
The apparatus reproduces at a certain distance the motion of advancement of the cloth as fast as it is woven on the loom. This result is obtained by unrolling a band of paper on which are marked automatically the hours of work and the various circumstances of work. The apparatus is worked electrically by a commutator and electric connections. —Bur. Text.

Knitting Machines and Knitted Fabrics. E. L. Muller, Pawtucket, R.I., U.S.A. E.P.184,186; Conv., 6/8/21.
Relates to the production of a knitted fabric for use chiefly in the manufacture of cord tyres. The method comprises a plurality of parallel cords or warps and a plurality of cross threads, each of which is lapped about two adjacent cords in such a way that chains of loops are formed around the cords. —A.

Mechanical Process of Weaving. E. Lambert and R. Pernin, of Paris and St. Denis. U.S.P.1,428,786, 12/9/22; Appl., 21/5/20.
In a power loom comprising a series of warp threads and with shed-forming and beating-up mechanism, and a series of spools of thread, the combination therewith of a rotary device for inserting the threads. —A.

Knitting Machines. W. Lacey and T. Widdowson, Nottingham. E.P.184,339, 17/8/22.
Circular machines fitted with vertical striping or patterning attachments, of the kind described in Spec. 12,552/08, are provided with a supplementary or pattern cam which may be caused to vary the number of guides in action, thus facilitating production of fancy outlined figures on hosiery, etc. —A.

Looms: Picking Motion, etc. W. Menzies, Scranton, Pennsylvania, U.S.A. E.P. 184,319, 17/8/22.
In a positive motion in which the shuttle is handed across the shed by bars, the bars enter into grooves in the shuttle and engage catches on the shuttle, while other fixed catches throw the shuttle catches out of action as required. —A.

Looms; Smallwares——. T. T. Jackson, Bolton. E.P.184,537, 14/8/22.
Refers to looms for weaving single or multiple webs. —A.

Knitting Machines. W. Spiers, Leicester. E.P.184,316, 17/8/22.
Relates to devices to permit the production in machines with two co-axial needle cylinders of patterns formed by various combinations of rib and plain stitches and in particular the basket or double 1/1 stitch effect. —A.

Knitting Machines. Cotton, Ltd., and W. and C. H. Aldridge, Loughborough. E.P.184,309, 17/8/22.
An attachment by means of which a pattern-wheel which controls the movements of points, carriers, etc., can be racked backwards and forwards predetermined distances so that in making open-work, embroidery effects, clocks, etc., in which parts of the pattern repeat, the corresponding sections of the pattern-wheel may operate any number of times before passing on. —A.

Knitting Machines. Wildt & Co. and E. Wildt, Leicester. E.P.184,031, 10/8/22.
Automatically-controlled mechanism for producing tuck-work in seamless stockings is arranged so that the tuck-work can be discontinued through the heel, etc., and continued at desired parts. —A.

4.—CHEMICAL AND OTHER PROCESSES.

(E)—DRYING AND CONDITIONING.

Dry Air Drying Apparatus. See Section 6.

(G)—BLEACHING.

Chlorine Water; Preparation of——. G. Braam. Z. angew. Chem., 1922, **35**, 501-502.
The author reviews briefly past and present methods of bleaching and describes an apparatus by means of which chlorine water of a definite concentration can be obtained quickly and cheaply. Water is introduced into the lower half of the apparatus, which is constructed of acid-proof clay, and a definite quantity of chlorine is introduced into the upper half. Absorption of the chlorine is effected by means of a stirring device of hard rubber controlled by a small motor and is complete in about one minute. The author believes this system will be widely adopted in the future. —B. C. I. R. A.

Sewing Thread; Bleaching——. Von Sellmann. Textilberichte, 1922, **3**, 304-305.
The author discusses some of the causes of the weakening of yarns in bleaching, and claims that the chief faults are (1) the use of lime in scouring, (2) the admission of air during chemicking, (3) careless

estimation of available chlorine, (4) neglect of the use of an "antichlor." Directions are given for the scouring and bleaching of a sewing thread of Egyptian cotton. The kier liquor contains sodium hydroxide, rongalite, pentapol and monapol oil; electrolytic chlorine is used for bleaching; and a second scour is recommended for a full bleach.
—B. C. I. R. A.

Reduced Pressure Kier. Rev. men. du Blanchissage, 1922, **17**, 29-30.
The author discusses the formation of clouds of steam in bleacheries when the kiers are opened. The only efficacious method of preventing the nuisance is to evacuate the kiers, and for this purpose the Sokopf apparatus appears to be the most suitable. It consists of an injector, supplied by the general water pipe, and connected to a pipe fixed to the highest part of the kier. Suction is created by the water passing through the outlet pipe of the injector, and all vapour is rapidly carried away and condenses on coming in contact with the water, thus creating a vacuum. By this means the boiling point of the water is lowered. At a temperature of 80°C., the boilers can be opened without fear of the formation of steam.
—B. C. I. R. A.

Hypochlorite. Textilberichte (from Textilchem., 1922, p.39), 1922, **3**, 314.
The author discusses the chemistry of the so-called chlorine bleach, pointing out that it may be either an oxygen or a chlorine bleach according to the conditions existing in the bleach bath. The chlorine bleach is much more searching than the oxygen bleach, and the free chlorine attacks the fibre. If it is desired to avoid the somewhat dangerous action of free chlorine, small quantities of soda should be added to the bath to prevent its becoming acid, but if a true chlorine bleach is desired acetic acid may be added to the bath.
—B. C. I. R. A.

American Wooden Tank and Vat Practice. See Section 4I.

(H)—MERCERISING.

Weft Distortion and Cloth Penetration. E. Farrell. Text. Merc., 1922, **67**, 252.
In the course of a lecture upon the subjects of weft distortion in finishing, machinery and methods of mercerising were dealt with. The lecturer advocated the use of anti-friction bearings as a palliative of the distortion trouble, which he attributed to the uneven wear of certain rollers. In connection with mercerising, it was stated that higher speeds and better products had resulted when increased penetration of the mercerising liquor were aided by operating under reduced pressure. The material treated in this way was found also to give less trouble in dyeing. —L. I. R. A.

Yarn; Mercerisation of——. L. A. Stead. Text. Colorist, 1922, **44**, 514-516.
A general account of the mercerisation of warp yarns, including statements on the production of lustre. It is said that untwisting of the single hairs precedes swelling up to an alkali concentration of 40°Tw., the reverse being the case above this point. Other agents cause swelling but no untwisting and therefore no lustre.
—B. C. I. R. A.

Knitting Yarn: Mercerisation. L. A. Stead. Text. World, 1922, **62**, 1133-1137.
A detailed account of the mercerisation of knitting yarns. It is contended that the process is more mechanical than chemical.
—B. C. I. R. A.

(I)—DYEING.

American Wooden Tank and Vat Practice. D. M. Newitt. Chem. Age, 1922, **7**, 270-273.
The author has drawn up curves showing the resisting power of various kinds of woods to acids and alkali and tabulated data referring to the expansion and contraction of various woods under the action of sulphuric acid and caustic soda. Of all the woods tested, cypress was found to withstand the action of the largest number of chemicals. It will withstand successfully 25% sulphuric acid and 10% nitric acid, and is the only wood which does not undergo destruction by boiling 25% caustic soda. From the curves, it seems that pine is very serviceable for use with sulphuric acid up to 10% concentration. Oak, although it has a low and nearly constant adsorption for sulphuric acid, has a very high adsorption for caustic soda. There is not much to choose between oak, cypress and pine for bleaching powder liquors. Pine also is specially resistant to hydrochloric acid, and is the only wood not badly attacked at a concentration of 50% of this acid. —L. I. R. A.

Dyeing Acetyl Silk. G. Emmons. Silk, N.Y., 1922, **15**, 55.
Alizarine dyes have an affinity for the acetyl fibre. Certain of the sulphonated azo dyes give very useful yellow and red shades. Some vat dyes, such as indigoids, alzols, etc., are suitable for this fibre, saponification being prevented by means of an ammonium salt. —F. G. P.

Dyeing of Cotton Warps; Naphthol AS and BS and their Use in the——. M. G. Morris. Amer. Dyestuff Reporter, 1922, **11**, 215.
Practical details are given for the use of these dyes. —L. M. S.

Mordants. W. D. Bancroft. Jl. Phys. Chem., 1922, **26**, 447-470.
Historical review of the theory and use of mordants. —B. C. I. R. A.

Dyeing Experiments; Comparative—— with Degummed Flax and Hemp. P. Krais. Text. Forschung, 1922, **4**, 101.
A short paper describing the behaviour of degummed flax and hemp, both as yarn and in the loose state, as compared with cotton. The following conclusions are drawn:—Degummed fibres show little difference from cotton on dyeing; direct colours are somewhat brighter on degummed flax; basic colours are more strongly coloured on degummed flax; degummed hemp dyes somewhat more intensely than degummed flax; fastness to washing is similar with cotton and degummed flax. —L. I. R. A.

Katanol and Tamol; Application of——. H. Wagner. Jl. Soc. Chem. Ind. (from Farben-Zeit., 1922, **27**, 3015-3016), 1922, **41**, 705A.
The mordanting properties of tannin and its substitutes, Tamol (a formaldehyde compound of a naphthalenesulphonic acid) and Katanol (a thiophenol) have been compared in the case of Auramine, Safranine T, Rhodamine B, Methyl Violet B, Methylene Blue BG, and Brilliant Green. Dyeings obtained by means of Tamol and Katanol, though slightly inferior in fastness to light, have a greater fastness to lime than dyeings obtained by means of tannin. On the whole, Tamol and Katanol are superior to tannin as mordants for basic dyestuffs, since they are cheaper and yield purer shades. —B. C. I. R. A.

Aluminium Mordant. W. D. Bancroft. Jl. Phys. Chem., 1922, **26**, 501-536.
In the second of a series of articles on mordants, the author deals with the use of aluminium derivatives, discussing:—(1) Hydrolysis of aluminium salts, (2) adsorption of aluminium sulphate by wool, (3) adsorption of aluminium tartrate, etc., by wool, (4) adsorption of alumina by silk, (5) adsorption of alumina by cotton. It is stated that if a substance like tannin, which adsorbs alumina strongly, is added to cotton, the fibre will then remove alumina from solutions of aluminium salts which are not decomposed by cotton alone. The increase in the adsorbing power of mercerised cotton is said to be due to a structural difference of the fibre. There is no evidence of the formation of any definite compound between alumina and silk, cotton, or wool. —B. C. I. R. A.

Loose Cotton; Dyeing——. Le Teinturier Pratique, 1922, **17**, 29-30.
Some practical notes on dyeing loose cotton and cotton waste, in dyeing machines, with chrysophenine, benzopurpurine, and direct black dyes, also on the production of compound shades by the combination of two or three colours. —B. C. I. R. A.

Carpet and Rug Yarns; Bright Colours and Tints on——. F. C. Holden. Amer. Dyestuff Reporter, 1922, **11**, 209.
Hints are given on the scouring and bleaching of the yarns, the preparation of the dye bath to avoid dulling effects, and on overcoming unevenness. —L. M. S.

The Alkali Resinates and their Application. See Section 10.

Weft Distortion and Cloth Penetration. See Section 4H.

(J)—PRINTING.

Shirting; Printing——. Text. Rec., 1922, **40**, 46.
A discussion of the merits of different blacks for printed shirtings. A perfect shirt black does not yet exist, aniline black being probably the most satisfactory. Where the black touches other colours a mixture of a vat black and a sulphur black is the most desirable colour to use. —B. C. I. R. A.

Backcloth: Control. R. Sansone. Canad. Text. Jl., 1922, **39**, 345-346.
Some notes dealing with the function, selection, washing, drying and changing of backcloths in the printing of cotton fabrics. —B. C. I. R. A.

(K)—FINISHING.

Weft Distortion and Cloth Penetration. See Section 4H.

PATENTS.

Degumming Silk. Soc. of Chem. Industry, Basle, Switzerland. E.P.184,788; Conv., 13/8/22.
Silk fabrics containing raw silk interwoven with silk dyed with vat dyestuffs are prevented from bleeding during degumming by the addition of a persulphate to the bath. In the example given, silk dyed with ciba violet B is boiled with 10 times the quantity of raw silk for 2 hrs. in a bath containing, per litre, 15 grm. Marseilles soap and 2 grm. potassium persulphate. —A.

Cloth; Fireproofing——. A. Arent, Assr. to Arthur Arent Laboratories, Iowa. U.S.P.1,418,610, 6/6/22; Appl. 9/6/20.
A solution of antimony trichloride in benzene is applied to shingles, cloth, or paper. —B. C. I. R. A.

Rubberized Fabrics, etc. P. Britton and Griffiths Bros. & Co., London. E.P. 184,578, 17/8/22.
In coating materials, latex is used instead of rubber solution. It may be first applied to a backing and the film then transferred to the material to be coated. —A.

Bleaching and Dyeing Vegetable and Animal Fibres. A. S. Roberts (to Surpass Chem. Co., New York). U.S.P. 1,429,775, 19/9/22; Appl., 30/3/21.
Process for dyeing and bleaching at the same time in a single bath, which comprises subjecting the material to be dyed to a bath having added thereto the dye, an alkaline oxidising agent, and a neutralising agent. —A.

Recovering Flax Fibre. R. E. Rindfusz and V. Voorhees (to American Writing Paper Co., New Jersey). U.S.P. 1,430,115, 26/9/22; Appl., 15/11/19.
Process of preparing high-grade paper pulp from flax tow. —A.

Cotton; Imparting Transparent Effects to——. H. Forster, Bruggen, Switzerland. U.S.P.1,430,163, 26/9/22; Appl., 21/9/20.
The process consists in subjecting the cotton to treatment with successive parchmentising reagents under different conditions of operation and thereafter mercerising the cotton; also, to treatment first with sulphuric acid below 50½°Bé, then with sulphuric acid above 50½°Bé and then with concentrated caustic alkali. —A.

Degumming Textile Materials. G. Jenny and O. Jaeck, Basle, Switzerland. U.S.P.1,430,523, 26/9/22; Appl., 16/6/20.
Improved biochemical process consisting in first preparing an aqueous degumming bath containing pancreatic amylase, biliary salts and a neutral salt, and treating the materials to be degummed with the said bath at temp. 58-60°C. —A.

Guiding Webs. A. and G. Wood, Stubbins, nr. Manchester. E.P.184,256, 8/8/22.
Relates to devices for guiding a cloth web into calendering, stentering, or other finishing machines. —A.

Fabric Printing Machines. T. R. Johnston, Tokyo. E.P.184,128, 10/8/22.
Refers to printing of webs of fabric with a continuous design by the offset process. —A.

Protecting Animal Fibres from Alkaline Liquids. A. G. Bloxam, London (Anilin Fabrication, Berlin). E.P.183,868, 27/7/22.
Animal fibres are protected from the action of alkalies in processes of wool washing, degumming silk, mercerising cotton (in half wool or half silk fabrics), dyeing, etc., by adding one or more of the following substances, in proportion of not less than 3% by weight of goods treated, namely, sugars such as glucose, fructose, etc., and sulphite-cellulose, waste liquor or the active constituents thereof. —A.

6.—ANALYSIS, TESTING, GRADING, AND DEFECTS.

Crystal Elements: Orientation. K. Becker, R. O. Herzog, W. Jancke and M. Polanyi. Zeitsch. Physik., 1921, **5**, 61-62.
Several methods are described whereby an axial orientation of crystal elements in various types of substances may be produced. (1) A crystalline powder placed in a magnetic field so arranges itself that individual crystalline particles take up positions corresponding with the inductive action. (2) Subjecting crystalline powders and substances like wax and paraffin to high pressures (4,000-5,000 atms.) brings about a marked regular arrangement of the particles. This is observed in the case of succinic acid, indigotin, and stearic acid. (3) The cold drawing of metals produces an axial symmetry of the elementary crystals of the metals. —B. C. I. R. A.

Silk Inspection. A. Rosenweig. Amer. Silk Jl., 1922, **41**, 65.
A correct description of the size of silk is important. In a test at Milan all the bales examined were incorrectly described; in some the variations ranged over four sizes, and in a particularly bad case the range was 11½ deniers (10—21½). —F. G. P.

Cocoon Production and Marketing in South China. D. E. Douty. Silk, 1922, **15**, 41.
The country methods of grading, testing and inspecting cocoons, which are bought on an agreed sample of dried, opened specimens are described. Eggs are sold in sheets of from 30,000-40,000. The quality of silk is far below that of Central China, the majority of the cocoons being imperfect. —F. G. P.

Cellulose: Hydrolysis. J. C. Irvine and E. L. Hirst. Jl. Chem. Soc., 1922, **121**, 1585-1591.
A method is described by means of which a 95% yield of glucose has been obtained from cotton cellulose, thus demonstrating conclusively that cellulose is composed entirely of glucose residues. —B. C. I. R. A.

Dry Air Drying Apparatus. K. Mohs. Chem. Zeit., 1922, **46**, 649-650 (c.f. S. H. Meihuizen, G.P.309,982).
The material, the moisture content of which is to be determined, is placed on a series of shelves in a long tube surrounded by a jacket containing the heating liquid. A narrow tube passes from the bottom of the inner tube, through the walls of the tube and the jacket and two wind screens, into a large bottle containing concentrated sulphuric acid, ending a short distance above the level of the acid. The material is thus heated in a draught of dry air, whereby it is much more quickly and efficiently dried. For most purposes, water is used as the heating liquid. —B. C. I. R. A.

Differentiation of Sucrose from other Sugars. F. Kryz. Chem. Trade Jl. (from Ost. Chem. Zeit., 1921, No. 19141), 1922, **71**, 264.

The writer claims that an acid solution of nickel ammonium sulphate is capable of differentiating sucrose from glucose and lactose. If 1 c.c. of an aqueous saturated solution of nickel ammonium sulphate and the same volume of sucrose solution (containing at least 0·005 gram) be mixed together, a few drops of concentrated sulphuric or hydrochloric acid added, and the mixture boiled, the green colour soon changes to yellow, then to light or dark red, depending upon the amount of sucrose present, this red colour being retained after the liquid has cooled. No colour change occurs when dextrose or lactose are thus treated, nor when protein bodies are present. The reaction in the case of levulose is not mentioned.

—L. M. S.

Moisture Content of Raw Cotton. M. R. de Ménibus. Bull. Soc. Ind. Rouen, 1921, **49**, 547-548.

An addition to the author's previous communication (this *Jl.* Abs., 1922, **13**, 137). He suggests that experiments, less numerous than those made by Th. Schloesing (see Hygroscopic Properties of Textile Materials, translation in *Textile World Record*, Boston, Nov., 1908, of report published in *Bull. Soc. d'Encouragement pour L'Industrie Nationale*, Paris, 1893), should be made to determine if the varieties of cotton cultivated in America always possess the hygroscopic properties found by Schloesing. At the same time an investigation might also be made as to the time cotton takes to attain its state of hygroscopic equilibrium; this time should vary with the temperature. If these experiments give results concordant with Schloesing's curves a research must be made to ascertain why the cotton delivered to the spinners has a different moisture content from that which it would normally have if it were simply submitted to the action of the atmosphere. —L. M. S.

Microscope Damp Chamber. C. H. Farr. Science, 1922, **56**, 227-228.

A type of damp chamber is described which is especially adapted for the study of cultures of mycelia of fungi under the 4 mm. objective of the microscope without disturbing the hyphæ by transferring them to a microscope slide and making a fresh mount. Several layers of filter paper cut to form a frame about 5 mm. in width are placed on a large-sized microscope glass. A little nutrient agar is dropped on the inner edge of the frame and inoculated with the fungus to be studied. A large cover-glass is then placed over the filter paper and the mount is bound together with linen thread and placed erect in a tumbler containing a little water. —B. C. I. R. A.

Cellulose: Fermentation. R. Hasenöhrl and J. Zellner. Monatsh., 1922, **43**, 21-41.

In an account of the chemical composition of fungi, it is stated that the existence of an enzyme which hydrolyses cellulose has not been proved by chemical methods. Extracts of the mycelia and sporangia of various fungi have now been tested against oak-wood and soda-cellulose, under different conditions, and again no zymolysis could be detected. This is surprising in view of the effect of fungus growth on felled trees, but an experiment on an oak infested with *Polyporus igniarius* is quoted, which shows that, although about 74% of the solid matter had disappeared, the loss was almost entirely at the expense of organic cell contents such as starch, sugar and tannins, whereas the crude fibre was almost intact. The failure to prove the existence of a cellulose-splitting ferment in the fungi may be due to the possibility of the ferment being insoluble, but it would then be difficult to understand how it could attack cellulose at all. Possibly, the hyphæ produce an oxidase which first oxidises the cellulose of the host, but this could scarcely account for the decay which takes place within a tree, in the absence of air. It seems more plausible, therefore, to ascribe cases of actual cellulose decomposition to bacterial action, with possibly a state of symbiosis existing between bacteria and fungi.

—B. C. I. R. A.

Cellulose: Isolation. U. Pomilio. Chim. et Ind., 1922, **8**, 41-45.

Further details of the Cataldi process in which free chlorine is used for the manufacture of pure cellulose (This *Jl.*, 1921, **12**, 491). The process furnishes good yields of a high-grade product, and allows the maximum quantity of gaseous chlorine to be employed, whilst reducing the consumption of fuel and alkali to a minimum. Favourable opinions of the process have been expressed. —B. C. I. R. A.

Moulds: Microscopy. F. A. Mason. Bull. Bur. Bio-Technology, 1922, **1**, 161-175.

In an article on the identification of micro-organisms which affect leather, the author gives a number of hints on microscopic technique. A mixture of pure phenol (2 parts), glycerol (1), lactic acid (2) and distilled water (2) is recommended for mounting moulds, except in the case of *Mucoraceæ*. —B. C. I. R. A.

Nephelectrometer. J. N. Kugelmass. Compt. rend., 1922, **175**, 343-345.

An apparatus is described which measures the degree of transparency of a liquid. Possible applications for the comparison of various colloidal solutions and for the study of the relative stability of various modifications are pointed out.

—B. C. I. R. A.

Calcium: Estimation. P. P. Laidlaw and W. W. Payne. Biochem. Jl., 1922, **16**, 494-498.

A colorimetric method for the estimation of small quantities of calcium is described, which depends on the insolubility of calcium alizarinate. It is accurate on 0·1 mg. to ·002 mg. —B. C. I. R. A.

Cellulose-Copper Complex. K. Hess and E. Messmer. Ber., 1922, **55**, 2432-2443.

The authors have shown, by new determinations of the rotation of cellulose in ammoniacal copper hydroxide solutions and by the application of the law of mass action, that for the soluble complex copper compounds of cellulose the ratio 1 $Cu : 2C_6H_{10}O_5$ is most nearly applicable, but multiples other than 1 :2 are possible. This ratio, however, is supported further by the composition of the cellulose-copper-sodium hydroxide complex which the authors have ascertained to be $Na_2(C_{12}H_{16}O_{10}Cu)$. Reference is made to the work of Traube (This *Jl.*, Abs., 1922, **13**, 187), whose conclusions concerning the constitution of the copper-cellulose compounds are similar to those of the authors, and were reached by different methods. —B. C. I. R. A.

Cotton: Staple Test. W. Frenzel. Med. Rijksvoorlicht. Vezelhandel, Delft, 1922, No.4, 29-35.

A further account with more practical details of the tests already described (This *Jl.* Abs., 1922, **13**, 154). The sample is formed by hand into a " staple," which is then piled in the angle of a bent sheet of squared paper, between two pins, so as to get all the hairs arranged with one end on the base line as far as possible. This is done by combing the tuft through a set of parallel combs, holding one end firm a short distance outside the teeth, and lifting out the hairs from between consecutive combs by means of a suitable pair of tweezers. The paper with the arranged tuft is then folded, placed in a desiccator over a solution of calcium chloride (50 grs. to 100 cc.) so as to adjust its moisture content, and then cut into layers 5 mm. apart, starting from the base line. Each section is then weighed, and the fragment of paper is removed and weighed. The weights of sections 0-5, 5-10, 10-15 mm., etc., long are thus obtained. These weights, divided by the lengths of the groups (5mm.), *i.e.*, the " weights per unit length," are presumed to be proportional to the number of hairs in each group. They are plotted against the mean lengths of the groups (2·5, 7·5, 12·5 mm., etc.) and the crown of the curve gives the maximum weight per unit length. This should correspond closely with the group 0-5, but it is difficult to lay all the hairs with one end on the base line. The weights per unit length, divided by the maximum weight, multiplied by 100, give the percentage of fibre 0-5, 0-10, 0-15, 0-20 mm., etc., long. If the axis of the curve along which the weights are plotted is divided by 100, it is possible to plot percentages of fibre of each length (Z) against lengths. This gives the staple diagram, which really reflects the curve joining the free ends of the hairs if these are supposed to be distributed evenly, in order of length, with one end on a base line. From the staple diagram, it is possible to see the maximum and minimum lengths at a glance, while the height of a rectangle of the same area as the space bounded by the curve and the axes gives the average length (l_0). The percentage of fibre 0-5, 5-10, 10-15 mm., etc., long is also read from the staple diagram and plotted against the mean lengths (2·5, 7·5, 12·5 mm., etc.). The crown of this variation curve gives the most frequent length. Finally, the variation, S, is calculated from the formula $S = \pm\sqrt{\Sigma Z(l-l_0)^2/100}$ and this may be recorded either in millimetres or as a percentage of the mean length. The mean length and most frequent length can also be obtained mathematically. The " staple length " as determined commercially is approximately equal to the mean length plus the variation. —B. C. I. R. A.

Cotton: Processing. W. Frenzel and J. H. Buskop. Med. Rijkvoorlicht. Vezelhandel, Delft, 1922, No.5, 41-51.

The authors describe an investigation into the effects of the various processes, from the raw cotton to mule spun yarn, on the average length of the fibres. The experiments were performed in a Dutch mill equipped for spinning 16-50's counts, and the tests were made at noon on a Thursday so as to avoid fluctuations due to the week-end stoppage. The data acquired were as follows:—(A) From the average of two " frequency curves " (see preceding abstract), the maximum fibre length, $l_{max.}$, the mean fibre length, l_o, the most frequent length, $l_{m.}$, and the variation, S. (B) The amount of straightening in the fibres, recorded as the ratio Y, of the length of the fibre when laid flat to the length when stretched out. (C) The amount of cleaning which had taken place, v, recorded as a percentage of clean fibre in the sample. For the estimation of the amount of straightening, 50 fibres from each sample were examined by the same person under the same conditions. These were carefully removed by a pair of tweezers, laid on a glass plate smeared with glycerol, measured with a millimetre scale, then stretched out and measured again. The degree of cleansing was also tested by hand. Samples weighing about 5 grams were held in one hand and sorted by means of tweezers into clean fibre, neps, and rubbish (leaf, sand, etc.). The results obtained are summarised in tables and are reproduced in graphs which show at a glance the effect of each process on the material, and these effects are discussed one by one. The total effect of all the processes is to reduce the mean fibre length by about 5%, and the most frequent length by about 12½%. The fibres are brought nearer to an average length, however, for the variation is also reduced by about 12%. —B. C. I. R. A.

Fungus: Germination. W. Brown. Annals of Botany, 1922, **36**, 285-300.

The author has studied the effect on the germination of fungal spores of volatile substances arising from plant tissues. The germination of *Botrytis cinerea* spores is increased by the action of volatile substances arising from certain plant tissues such as apple leaves and fruit, leaves of Ruta, Eucalyptus, etc. In other cases, for example, with potato tissue, reduced germination or even inhibition is produced. Spore germination is also depressed by the presence of wet filter or blotting paper. Similar stimulating and retarding effects can be produced by the action of simple chemical substances, such as ethyl acetate. Other fungi were found to behave similarly. The bearing of these results on general mycological technique and on problems of physiological parasitism is discussed. —B. C. I. R. A.

Fluorides; Estimation of——. N. K. Smitt. Bull. Bur. Bio-techn., 1922, **1**, 176-178.

Details are given of methods for the detection and titration of soluble fluorides, depending on the fact that fluorides form sparingly soluble ferrifluorides with ferric chloride. A thiocyanate is used to indicate the end-point of the reaction.
—B. C. I. R. A.

Protoplasm: Permeability H. Kahho. Biochem. Zeits., 1921, **123**, 284-303.

An investigation of the permeability of plant plasma for neutral salts in relation to their poisoning effect (compare This *Jl.* Abs., 1922, **13**, 136). Young roots of yellow lupin and isotonic solutions of neutral salts were employed throughout the experiments. It was found that the permeability is dependent on both ions and that their action is additive. The relative effect of the anions and cations is discussed. The anions, arranged according to the lyotropic series $I > Br > NO_3 > Cl >$ tartrate $> SO_4 >$ citrate, increase the permeability and the cations, arranged according to the series $K < Na < Li < Mg < Ba < Ca$, retard it. The poisoning effect of neutral salts on plant plasma is very closely related to the permeability of the plasma for the salt solutions and increases with increase of permeability. —B. C. I. R. A.

Amyloses: Heat of Combustion. P. Karrer. Ber., 1922, **55**, 2854-2863.

The heats of combustion of di-, tri-, tetra-, hexa-, and octa-amyloses, lævoglucosan, cellobiose and stachyose have been determined, using a bomb with which an accuracy of 1—2% was assured. The heats of combustion of triamylose and beta-hexamylose were found to be identical, which confirms the crystallographic evidence of the identity of these compounds. —B. C. I. R. A.

Indicators; Mixed——. A. Cohen. Jl. Amer. Chem. Soc., 1922, **44**, 1851-1857.

The use of mixed indicators of the sulphone-phthalein class increases the precision of hydrogen ion concentration determination in certain cases and gives sharper end points in titrations. Coloured liquids can also be titrated accurately.
—B. C. I. R. A.

Micro-Kjeldahl Apparatus. H. Winkler. Chem. Zeit., 1922, **46**, 785.

A device is described for preventing loss of liquid by spurting in Kjeldahl estimations on a micro-chemical scale. The top third of a Jena glass test tube is widened so that there is a ledge round the tube. A contrivance consisting at its lower end of a funnel-shaped tube rests on this ledge and closes the test-tube. At its upper end the funnel-shaped tube opens into an ordinary distillation bulb.—B. C. I. R. A.

Water: Hardness. G. Weissenberger. Z. angew. Chem., 1922, **35**, 177-179.

The author shows, by practical examples, that his potassium palmitate method and the modified soap method for estimating the hardness of purified boiler feed waters can be employed for estimating the hardness of crude waters for technical purposes. —B. C. I. R. A.

Lignin; Constitution of——. R. Willstätter and L. Kalb. Ber., 1922, **55**, 2637-2652.

The authors agree with the views of Fuchs and Jonas, and do not accept the "aromatic" nature of lignin. Practical details are given of a comparative investigation of the reduction of lignin and of carbohydrates by means of hydriodic acid and phosphorus. The very similar behaviour of these substances seems to indicate their close constitutional relationship. As end products of the reaction, both classes of substances yield similar mixtures of hydro-carbons which can be separated into a liquid fraction readily soluble in acetone, and a solid fraction difficultly soluble in acetone. Investigation has led the authors to regard this as a mixture of substances of hydrogenated ring structures in which the number of rings increases with increasing molecular weight. Tables are reproduced showing the yield and analysis of the reduction products obtained from lignin, cellulose and glucose. —B. C. I. R. A.

Micro-Analysis Apparatus. M. Nicloux and G. Welter. Chim. et Ind., 1922, **8**, 269-272.

A discussion of the advantages of Pregl's methods of micro-analysis and an outline of the methods of estimation of carbon, hydrogen, nitrogen, the halogens, sulphur, methoxyl, ethoxyl and methylimide groups. Modifications of the micro-Liebig and micro-Dumas methods, proposed by Dubsky, are discussed. —B. C. I. R. A.

Colloids. R. Zsigmondy. Z. angew. Chem., 1922, **35**, 449-451.

A short summary of the present state of knowledge of the structure of colloids.
—B. C. I. R. A.

Glarimeter. H. Schulz. Deuts. Faserstoffe, 1922, **4**, 85-87.

The principle of the new glarimeter for measuring the " gloss " of artificial silks is as follows:—A divergent pencil of rays from a steady source of light passes through a lens so arranged that the emergent parallel beam is reflected from the surface under investigation on to a prism which directs it to one surface of a photometer cube. Diffused rays, reflected from the glossy surface at a definite angle, traverse a second prism and fall on the opposite face of the photometer cube. The line of separation of the cube is viewed through an eye-piece. The difference in luminosity of the two fields is a measure of the gloss of the given surface.
—B. C. I. R. A.

Textile Research in Germany. P. Krais. Chem. Zeit., 1922, **46**, 856.

Reference is made to the work of the physical-chemical section of the German Textile Industry Research Institute, Dresden, during the past three or four years. The following themes exemplify the classes of work undertaken:—Influence of the addition of chemical agents on the retting of flax and hemp; improvement in the spinning and felting properties of vegetable and animal hairs; disintegration of wood, for the production of pure cellulose; cottonising of flax and hemp waste. Mainly physical problems include: —A study of the sorption of moisture, the tensile strength, the elongation at break, the torsional rigidity, the brittleness, etc., of single fibres; a study of dietetic influences in the case of fibre-yielding animals, of cultural influences in the case of fibre-yielding plants, of the effects of the processes, of preparation, scouring, bleaching, dyeing and finishing, and of the effects of light and storage, on the foregoing properties of the single fibre. " The aim must be to learn from the properties of the single fibre (which requires only very little material) how to predict exactly how the fibre will behave in the course of manufacture and wear. If this is achieved, a great advance will be assured." —B. C. I. R. A.

Length of Fibre; The Use of Frequency Curves as regards——. E. A. Fisher. Text. Rec., 1922, **40**, 39-40.

The use of frequency curves in determinations of staple length is discussed and illustrated by reference to wool tops.
—B. C. I. R. A.

Sodium Hyposulphite (" Hydros "): Estimation. Text. Colorist, 1922, **44**, 585-586.

Full practical details of the indigo carmine method and a short account of the silver method are given.—B. C. I. R. A.

Standard Dropping Pipette. H. Halphen Chem. Abstr. (from Pharm. Zentralhalle, 1921, **62**, 767-768), 1922, **16**, 2797.

A pipette which will deliver 20 drops of water per gram should have an orifice 3 mm. in diameter (external measurement). Such a pipette can be made by drawing out a glass tube at one end and passing this narrow portion as far as it will go through a 3 mm. hole drilled in a brass plate. The tube is then cut exactly at the surface of the plate.
—B. C. I. R. A.

Dextrin and Starch: Specific Heat and Heat of Wetting. Sprockhoff. Jl. Soc. Chem. Ind. (from Z. Spiritusind, 1922, 45, 217), 1922, **41**, 723A.

The specific heat of dextrin was determined calorimetrically by mixing with petroleum. The average figure was 0·355 for anhydrous yellow dextrin and 0·363 for the white variety. The " heat of wetting " was obtained by moistening the dextrin directly with water or by adding water to a petroleum suspension of dextrin. An average figure of 16·5 cals. per grm. was found. Experiments with starch showed that the greatest heat evolution occurred on the addition of the first 1% of water.
—B. C. I. R. A.

Extraction Apparatus. Fayolle and C. Lormand. Chim. et Ind., 1922, **8**, 273-274.

A new apparatus for the continuous extraction of liquids by non-miscible liquids is described and illustrated. The apparatus is made in two forms, which are employed according as the solvent is more or less dense than the liquid to be extracted. In the former case, the solvent enters at the top of the apparatus, passes through the liquid, and is siphoned off from the bottom. In the second case, the solvent enters at the bottom of the apparatus, passes up through the liquid, and is siphoned off at the top. The apparatus is, in both cases, so constructed that the production of emulsions, and frothing, are impossible.—B. C. I. R. A.

Glycogen: Action of Light. G. Bayer. Biochem. Zeits., 1921, **124**, 97-99.

In an investigation of the action of light on glycogen it was found that the unexposed half of a fresh sample was still soluble after a year, but a very considerable proportion of the exposed sample was insoluble. The soluble portion of the exposed sample consisted of unchanged glycogen. The insoluble portion was found to be soluble in a hot 60% solution of potassium hydroxide yielding an opalescent solution from which glycogen was precipitated on the addition of alcohol. The author suggests that the insoluble portion of the exposed sample is a polymeride of glycogen, but indicates other possible explanations of the change.
—B. C. I. R. A.

Adsorbent Powder: Surface Area. F. Paneth. Z. Elektrochem., 1922, **28**, 113-115.

A method for determining the surface area of sparingly soluble compounds of elements possessing radioactive isotopes is described. If, for example, lead sulphate is shaken up with some thorium-B, adsorption equilibrium is speedily attained and the ratio of lead to thorium in the solution will be the same as the ratio in the surface of the lead sulphate. The amount of lead in the surface can therefore be calculated, and in the case studied was one-thousandth of the total mass. When the dye Ponceau 2R was adsorbed by the lead sulphate it could now be calculated that only 31% of the total surface was covered at the maximum adsorption. —B. C. I. R. A.

Hypochlorite. N. O. Engfeldt. Z. Physiol. Chem., 1922, **121**, 18-61.

An investigation of the action of Dakin's solution on the chief groups of substances occurring in the living cell. The composition of the solution was approximately 0·5% sodium hypochlorite, 0·5% sodium carbonate, 0·45% sodium bicarbonate, and its action on the following substances was investigated:—(1) Carbohydrates, (2) fats and their products of hydrolysis, (3) proteins and their products of hydrolysis, (4) ammonia, (5) certain aldehydes.

—B. C. I. R. A.

Dew Point Hygrometer. Wa. Ostwald. Z. angew. Chem., 1922, **35**, 443-444.

An apparatus for determining the dew point of gases is described. It uses essentially a wet and dry bulb thermometer and these are adjusted to register the same temperature, that is, the dew point, by regulating the velocity of the stream of gas through the apparatus. For convenience, the two thermometer bulbs are attached to one stem, which is supplied with an ordinary centigrade scale and a scale for registering grammes of water per cubic metre of gas at 0°C. For generator and similar gases, the thermometers are placed in a Dewar flask, but for gases the dew points of which are less than 10° above room temperature the Dewar flask is replaced by a glass vessel containing ice and water or other cooling agents. In addition, the stream of gas can be so regulated that the mercury levels are maintained constant when any fluctuation of the mercury indicates a fluctuation in the dew point. —B. C. I. R. A.

Immersion Refractometer. J. Becka. Z. physiol. Chem., 1922, **121**, 288-299.

Mathematical formulæ are deduced by means of which refractometer readings can be used to determine the concentrations of salt solutions and to investigate quantitatively reactions involving precipitates when two solutions are mixed.

—B. C. I. R. A.

X-Ray Fibre Diagram: Interpretation. M. Polanyi. Zeitsch. Physik, 1921, **7**, 149-180.

The author assumes that a crystalline body has a simple ideal "fibrous" structure, if all crystal particles in it lie in a known crystallographic direction relative to a fixed direction on the body. The paper deals with the theoretical cases of X-ray "fibre diagrams" for monochromatic radiation incident on the body.

—B. C. I. R. A.

X-Ray Fibre Diagram: Interpretation. K. Weissenberg. Zeitsch. Physik, 1921, **8**, 20-21.

Herzog and Jancke, by radiating certain fibrous biological preparations (muscles, nerves, tendons, hairs) with monochromatic X-rays, have observed certain symmetrical diagrams on the photographic record. There is a certain similarity in nature between these diagrams and those obtained in the Debye-Scherrer method in which so-called amorphous substances are radiated by X-rays. The author now examines the possible origin of such fibre diagrams in the case of substances with axial symmetry. Two forms are considered in detail, namely, "spiral" and "ring" filament diagrams. —B. C. I. R. A.

X-Ray Fibre Diagram: Interpretation. M. Polanyi and K. Weissenberg. Zeitsch. Physik, 1922, **9**, 123-130.

A theoretical paper in continuation of earlier work. —B. C. I. R. A.

Membrane Filter. G. Jander. Z. angew. Chem., 1922, **35**, 269.

An additional smoothness may be imparted to the surface of membrane filters as follows:—The filter is immersed in distilled water and heated at 75-80°C. for about half an hour. It is transferred while still wet to a piece of plate glass and covered with a second similar plate. No air bubbles must be left between the filter and the glass. The plates are secured by screw clips so that the filter is under pressure. This apparatus is immersed in distilled water and maintained at 75-80°C. for one hour, the screw clips being tightened from time to time. When the glass plates are removed the filter will be found to have acquired a smooth surface from which precipitates may be scraped as from porcelain. As regards flexibility and resisting power the filter remains unchanged, but the period of filtration is increased by this treatment. A still smoother surface may be obtained by heating the prepared plates to 90°C. in a saturated atmosphere. Membrane filters must be stored under distilled water, but the water requires frequent changing to prevent the growth of fungi. Less frequent renewal is necessary if a piece of clean copper foil is placed in the dish containing the membranes. —B. C. I. R. A.

Electro-Endosmosis Apparatus. P. H. Prausnitz. Z. Elektrochemie, 1922, **28,** 27-36.

After an introduction dealing with the experimental study of electroendosmosis, an account of various technical applications is given. These include the drying of peat and clay, tanning; dyeing; purification of alkaloids, gum, and gelatin; fractionation of albumins and preparation of sera; sterilisation of fodder; separation of emulsions and purification of petroleum. —B. C. I. R. A.

The Testing of Raw Cotton as regards Humidity. A. Mabire. Report, 11th International Cotton Congress, 1922, 115-118.

The work of the raw cotton testing house, established at Havre, to determine as accurately as possible the moisture content of cotton on arriving at the port, and hence its true invoice weight, is discussed. The author emphasises the need for similar testing houses in other European ports, especially Liverpool. —B. C. I. R. A.

Plant Life; The Role of Celluloses in——. R. W. Thatscher. Science, N.S., 1922, **55,** No.1412, 80.

Celluloses are classified into hemicelluloses, normal celluloses, and compound celluloses. Hemicelluloses are said to be amorphous polysaccharides which are probably reserve carbohydrates deposited in the structural or cell wall materials rather than in storage organs. Normal celluloses are regarded as amorphous polysaccharides exhibiting a fibrous structure instead of the granular structure of starches. Compound celluloses are considered to be rather colloidal complexes or definite chemical compounds of true cellulose with encrusting materials. —L. I. R. A.

Lubricant. W. B. Hardy and I. Doubleday. Proc. Roy. Soc., 1922, A.**101,** 487-492.

Continuing their investigation (This *Jl.*, Abs., 1922, **13,** 114) the authors have studied the effect of temperature on the lubricating qualities of certain lubricants over a range of 15° to 110°C. It was found that the friction of clean faces of quartz, steel, or bismuth, when thoroughly freed from adherent films, is sensibly independent of temperature over this range. When the lubricant was fluid throughout the whole temperature range, the friction was independent of the temperature. When the lubricant was solid over part of the range, the friction was found to fall with rise of temperature up to the melting point, at which point there was a discontinuity, the friction falling to zero. When the lubricant was fully melted, the friction suddenly reappeared at a higher level than before the discontinuity, and was constant over the remainder of the temperature range. The significance of these results is discussed.—B. C. I. R. A.

Surgical Cotton Wool: Specification. Med. Rijksvoorlicht. Vezelhandel, Delft, 1922, No.6, 59.

A short account of specifications and tests for surgical cotton wool and gauze, as recommended for the Dutch Pharmacopœia. —B. C. I. R. A.

Protein Solution: Osmotic Pressure. J. Loeb. Jl. Amer. Chem. Soc., 1922, **44,** 1930-1941.

When acid is added to protein solutions the osmotic pressure is first increased and then decreased. It is deduced from the Donnan equation of membrane equilibrium that this is merely due to the difference of crystalloidal ion concentration inside and outside of the membrane. Quantitative confirmation is found by electrometric determination of the potential difference between a case in chloride solution inside a membrane and the osmotic equilibrium liquid outside the membrane. —B. C. I. R. A.

Protective Colloid: Catalytic Inhibition. T. Iredale. Jl. Chem. Soc., 1922, **121,** 1536-1542.

The inhibitive effect of gelatin on the catalytic decomposition of hydrogen peroxide by colloidal platinum is investigated in detail. The conclusion is drawn that adsorption is the controlling factor in the phenomenon. An "inhibition number" has been obtained which is defined as that percentage of protective colloid which is just insufficient to inhibit catalytic action, and the ratios of these numbers for different protective colloids are found to follow the same order of magnitude as the ratios of the gold numbers.—B. C. I. R. A.

Lubricant: Theory. R. E. Wilson and D. P. Barnard. Jl. Ind. Eng. Chem., 1922, **14,** 682-683.

In an abstract of a paper on the mechanism of lubrication, it is shown that under certain adverse conditions, especially at slow speeds and high loads, or where the oil supply is inadequate, a perfect fluid lubricating film cannot be maintained, and lubrication of the rubbing surfaces depends on the ability of a very thin, probably semi-solid, film of lubricant to adhere to the metal surfaces in spite of the pressure tending to squeeze it out and the abrading effect due to motion. This fundamental property of lubricants is termed "oiliness." —B. C. I. R. A.

Gelatin: Purification. S. E. Sheppard, S. S. Sweet and A. J. Benedict. Jl. Amer. Chem. Soc., 1922, **44,** 1858-1859.

Gelatin is freed from mineral matter by electrolysing aqueous systems under specified conditions and then coagulating with acetone. —B. C. I. R. A.

Flour: Moisture Content. E. H. Vogelenzang. Chem. Zentr. (from Chem. Weekblad, 1922, **19**, 251-252), 1922, iv, 385.

The application of different processes for the estimation of moisture in potato flour leads to results varying by as much as 1%. Constant weight is soon attained by drying in ordinary air, but the water is not entirely removed from the sample. Two samples of maize starch were dried at 98° in pre-dried air. By further "drying" in ordinary air they took up again 0·4% water. A standard process yielding results approximating most closely to the true moisture content appears to be desirable. —B. C. I. R. A.

Oil: Viscosity. W. H. Herschel. Jl. Ind. Eng. Chem., 1922, **14**, 715-723.

It is shown that there is no satisfactory theoretical equation for the change of viscosity with temperature. Various empirical equations are discussed and the limits of their applicability defined.
—B. C. I. R. A.

Gelatin Jelly: Rigidity. S. E. Sheppard, S. S. Sweet and A. J. Benedict. Jl. Amer. Chem. Soc., 1922, **44**, 1857-1866.

The rigidity of gelatin jellies of a wide range of hydrogen ion concentration has been determined. Alum is found to increase the rigidity. It is pointed out that Poisson's ratio for bodies which suffer no volume change decreases with increasing extension and is not constant as some previous authors have assumed.
—B. C. I. R. A.

Oil: Viscosity. H. W. Fulweiler and C. W. Jordan. Jl. Ind. Eng. Chem., 1922, **14**, 723-724.

The absolute viscosity of a number of samples of petroleum, animal and vegetable oils has been examined. All of these samples showed changes in viscosity when the material was allowed to stand in glass viscosimeters for 24 hrs. With two samples which were tested again after standing for a number of weeks the sign and magnitude of the change was almost the same as that observed after 24 hrs. standing. Apparently samples of oil intended as viscosity standards should be checked from time to time until more is known regarding the nature and extent of the change on standing. —B. C. I. R. A.

Osmometer: Preparation. W. Brown. Annals Bot., 1922, **36**, 433-439.

Some practical notes on the preparation and use of collodion osmometers. The author deals with (1) preparation of air-dried membranes or "thimbles," (2) grading and method of attachment, (3) method of using collodion osmometers.
—B. C. I. R. A.

Gel: Influence on Reaction. R. E. Liesegang. Z. angew. Chem., 1922, **35**, 365.

Two chemical reactions may apparently influence one another even at a distance of 5 cm., as may be demonstrated by using a jelly as the reacting medium. For example, rings produced by two drops of silver nitrate solution on gelatin films containing sodium chloride grow more rapidly towards one another than in any other direction, yielding pear-shaped forms. This is explained by supposing that silver nitrate diffuses more rapidly in the absence of sodium chloride. Confirmation is obtained by studying the picture produced when the gelatin contains both chloride and dichromate, for it will be found that the silver chromate is less transformed into chloride on the adjacent sides of the drops. Similar growth forms can be obtained with drops of alkali on gelatin films containing litmus and hydrochloric acid. —B. C. I. R. A.

Gum Mastic Sol: Coagulation. H. D. Murray. Phil. Mag., 1922, **44**, 401-415.

The influence of the size of the particle on the adsorption of electrolytes has been tested with a series of gum mastic sols obtained by fractional coagulation with hydrochloric acid. It is found that the minimal concentration of electrolyte for precipitation is higher the smaller the particles. —B. C. I. R. A.

Elastic Gels: Structure. E. Hatschek. Biochem. Jl., 1922, **16**, 475-478.

By the examination of the septa produced by covering a 10% gelatin gel in a 2% solution of potassium ferrocyanide with a 5% solution of copper sulphate it is deduced that septa should be produced in any reaction in which (1) a semi-permeable membrane is produced, (2) the solution above the gel is and remains hypertonic, (3) the gel contains a lyotropic agent which in moderately high concentration reduces its modulus and elastic strength.
—B. C. I. R. A.

Filter Paper: Electric Endosmose. A. Strichler and J. H. Mathews. Jl. Amer. Chem. Soc., 1922, **44**, 1647-1662.

The rate of endosmose has been determined for nine organic liquids, using filter paper as the membrane. The effects produced by (*a*) varying the permeability of the membrane, (*b*) varying the applied potential, (*c*) varying the temperature, (*d*) adding acid and alkali, (*e*) adding certain salts, (*f*) adding water, have been investigated, the results being given in tables and graphs. The establishment of the original charge on the membrane is stated to be due to the orientation of the solvent molecules on it, and to be influenced by specific adsorption of any ions present.
—B. C. I. R. A.

Lubricant: Theory. R. E. Wilson and D. P. Barnard. Jl. Ind. Eng. Chem., 1922, **14**, 683-695.

"Oiliness" of lubricants is defined, and it is shown that its importance under practical operating conditions is greater than is generally recognised. A variety of possible methods of measuring "oiliness" is discussed. —B. C. I. R. A.

Dibasic Organic Acids: Surface Tension. H. H. King and R. W. Wampler. Jl. Amer. Chem. Soc., 1922, **44**, 1894-1902.

The surface tension of aqueous solutions of various dibasic organic acids and some of their esters has been determined by the drop method and the adsorption at the liquid-vapour interface calculated. The esters are adsorbed more than the dibasic acids and the latter less than monobasic acids. The results are explained on the chemical hypothesis, the effect of various polar groups of the molecules being indicated. The hypothesis is also employed to explain catalysis. —B. C. I. R. A.

Dialysed Gelatin: Properties. D. Jordan Lloyd. Biochem. Jl., 1922, **16**, 530-539.

By the measurement of the minimum concentration of gelatin required to produce a gel under given conditions, a quantity is obtained which is taken to be an inverse measure of the "gelling power." The effect on both "gelling power" and turbidity has been determined for the addition of sodium chloride at both 0·4 *N* and 1·0 *N* concentration to gelatin in aqueous solution, in the presence of hydrochloric acid and in the presence of sodium hydroxide. The results are graphically represented. It is also found that (1) aqueous solutions of gelatin are not precipitated by salts of the heavy metals, and (2) the optical rotation of gelatin solutions varies with temperature and the nature of the solution. The above properties are shown to be in agreement with Lloyd's theory of sols and gels. —B. C. I. R. A.

Surface Tension Dynamometer. Marcelin. Compt. rend., 1922, **175**, 346-348.

An apparatus is described which is capable of rapidly and accurately measuring the surface tension of a liquid. The essential part is a brass stirrup to the open ends of which a thin strip of mica is attached by means of thin rubber bands. The stirrup is placed horizontally in the liquid, about half immersed, with the plane of the mica strip vertical. The movements of the mica are magnified optically. Experiments with oleic acid solutions are described and the existence of a "saturation surface tension" and of a hysteresis effect on contraction and extension of the surface are established. —B. C. I. R. A.

Cuprammonium Cellulose Solution: Viscosity. R. A. Joyner. Jl. Chem. Soc., 1922, **121**, 1511-1525.

An improved method is described for the determination of the viscosity of solutions of cellulose in cuprammonium hydroxide. The effect of air and of sucrose, sodium chloride, and sodium sulphate on the viscosity of the solution is studied. Linear relations are established between the log. viscosity and the composition of the solution, *i.e.*, concentrations of cellulose, copper, and ammonia. —B. C. I. R. A.

Surface Tension Dynamometer. R. B. Elder. Jl. Phys. Chem., 1922, **26**, 558-562.

The author points out certain errors in Bhatnagar's method of measuring the surface tension of water in contact with air, carbon dioxide and other gases. Bhatnagar's interpretation of Ferguson's formula is also stated to be incorrect. His results, therefore, are of little value as regards absolute accuracy.—B. C. I. R. A.

X-Ray Diffraction Apparatus. W. P. Davey. Gen. Elec. Rev., 1922, **25**, 565-580.

An illustrated description of an apparatus by which the characteristic X-ray diffraction patterns of fifteen powdered crystals may be taken at once. —B. C. I. R. A.

Transparent Solids: Stress-Optical Effect. L. N. G. Filon and H. T. Jessop. Phil. Trans., 1922, A.**223**, 89-125.

A Babinet compensator is used to measure the retardation of sodium light in materials strained beyond the elastic limit by simple pressure or tension. Glass shows no time or residual effect. Nitro-cellulose shows an immediate effect on loading, proportional to the load, followed by a creep towards an equilibrium value. On loading, there is a corresponding fall and creep towards the original zero. The strains were simultaneously measured with an extensometer with similar results. The results are expressed mathematically and are explained by supposing celluloid to consist of a fine grained elastic skeleton and a plastic magma, the effect of the latter decreasing with age. The optical effect is explained as being due to the state of stress, not strain.—B. C. I. R. A.

Artificial Silk; Tendering of——. Deuts. Faserstoffe, 1922, **4**, 78.

The tendering of Chardonnet silk may be due to the presence of cellulose sulphates. These spontaneously liberate sulphuric acid, which attacks the fibre, forming lustreless hydrocellulose and destroying the colour if this is sensitive to acids. Reference is made to several other causes of tendering in artificial silk goods. —B. C. I. R. A.

X-Ray Camera. H. Küstner. Physikal. Zeitschr., 1922, **23**, 257-262.
Modifications of the Debye-Scherrer method of X-ray photography are described. The new camera enables sharp spectrum lines to be obtained and reduces the time of exposure very considerably. Accuracy of measurement is increased by employing rays which leave the anticathode tangentially. Secondary and tertiary rays proceeding from the slit of the camera are eliminated. The scattering of the diffused secondary rays by the preparation employed is reduced to a minimum by causing the fine powder to adhere to a silk thread. —B. C. I. R. A.

Suspensions: Action of Light. R. Audubert. Ann. de Physique, 1922, **18**, 1-83.
The transmitting power and dispersivity of dispersed systems of sulphur, and the mobility of the particles and electrical conductivity of the dispersion medium; the absorption of light by solid sulphur, mastic and gamboge; the period of coagulation and the mobility of the particles, in the presence and absence of certain cations, of dispersed systems of mastic and gamboge, have been studied under the influence of different radiations. It is shown that the acceleration of the rate of decrease of the dispersion is a function of the wave length of the incident light, being negative for long waves and positive for short, yellow light (about $0{\cdot}6u$) being equivalent to absence of radiations. The adsorption of ions by mastic and gamboge suspensions is also aided by long waves and repressed by short, yellow light being without effect. A hypothesis is presented which involves energy changes in the peripheral electrons by the radiations. The concentration-adsorption relationship between cations and mastic and gamboge suspensions, as measured by the mobilities in the presence and absence of the ions, is shown to conform to an exponential law deduced dynamically.
—B. C. I. R. A.

Bingham Viscosimeter: Calibration. W. H. Herschel. Jl. Ind. Eng. Chem., 1922, **14**, 724.
The drainage error of the Bingham viscosimeter has been investigated. A special instrument was made with a bulb similar in shape and size to that of the Bingham instrument, and so arranged that the drainage error could be measured by calibration with liquids of various viscosities. A diagram shows the correction factors by which the constant C of the Bingham viscosimeter, obtained by calibration with water, must be divided to obtain the value to be used in obtaining the viscosity of liquids having a higher viscosity than that of the calibrating liquid. The diagram may also be used to determine the time of flow necessary to render the drainage error negligible.
—B. C. I. R. A.

Carbohydrates: Moisture Content. C. A. Browne. Jl. Ind. Eng. Chem., 1922, **14**, 712-714.
In tests in which dried carbohydrates were exposed to atmospheric humidity (60%) starch showed the greatest moisture absorptive power during the first hour than cellulose and agar. Lævulose was eleventh on the list. The lowest absorption was shown by dextrose, mannitol and sucrose. In a saturated atmosphere the lævulose-containing materials showed the highest, mannitol the lowest, absorptive power. When the samples were allowed to come to equilibrium under ordinary atmospheric conditions after exposure to 100% humidity all lost moisture except lactose and raffinose, which showed a slight gain for many months. Sugars which absorbed moisture in excess of the monohydrate form lost moisture to the point of monohydration. Sucrose continued to lose moisture during a period of two years. While the absorptive power of the substances studied was highest in periods of high humidity and lowest in periods of lowest humidity no fixed relationship could be established between percentage humidity and moisture content, owing to the rapidity of atmospheric fluctuations and the lag in the absorptive power of each material.—B. C. I. R. A.

Adsorption. O. Ruff. Koll. Zeitsch., 1922, **30**, 356-364.
Dispersed systems and adsorption are usually discussed from the point of view of surface and surface energy only. The phenomena are now considered in a different light, namely, that of chemical affinity. Any surface is co-ordinatively unsaturated and able to react (combine) with other molecules, such as those of the dispersion medium. The stability of these adsorption compounds, and hence that of the dispersed particles, is dependent on the heat motion of the particles, especially of the smaller ones, and on the affinities of the surfaces (the " surface valencies "), on the dispersion medium, or on the affinities of the dispersion medium and foreign molecules. The ageing, viscosity, coagulation and gelation of dispersed systems are explained, and the various dispersed systems possible with two phases are indicated. —B. C. I. R. A.

Hypochlorous Acid: Ionization. W. A. Noyes and T. A. Wilson. Jl. Amer. Chem. Soc., 1922, **44**, 1630-1637.
New determinations of the conductivity of hypochlorous acid and of sodium hypochlorite give the value $K_a = 6{\cdot}70 \times 10^{-10}$. Chlorine monoxide, and not hypochlorous acid, escapes when a current of air is passed through a solution of hypochlorous acid. This indicates that the acid undergoes amphoteric ionization, producing some positive chlorine ions in addition to hydrogen and hypochlorite ions.
—B. C. I. R. A.

Balancing Column Densimeter. E. Wiedbrauck. Z. anorg. Chem., 1922, **122,** 167-170.

Two small U tubes, each with one end open to the atmosphere, are connected to one another and to a mercury levelling tube by a T piece. One tube contains the comparison liquid of known density (water), the other the liquid to be examined. The interior pressure is made different from atmospheric by means of the mercury levelling tube and the difference in heads is observed, whence the desired density is obtained directly. Compared with those obtained by pyknometric and hydrometric methods the results are accurate to within 0·2%. Corrections due to capillarity, etc., fall within the limit of experimental error. —B. C. I. R. A.

Adsorption. J. N. Mukherjee. Phil. Mag., 1922, **44,** 321-346.

The author reviews briefly various theories of adsorption and then discusses the application of his own theory to various cases of adsorption from solution, to soil acidity, and to membrane permeability. —B. C. I. R. A.

Colloid: Coagulation. A. Westgren and J. Reitstötter. Jl. Phys. Chem., 1922, **26,** 537-547.

An outline of Smoluchowski's kinetic theory of coagulation and a short survey of the experimental work which has been carried out to test the theory. —B. C. I. R. A.

Colloid Particle: Distribution. A. W. Porter and J. J. Hedges. Phil. Mag., 1922, **44,** 641-651.

A determination of the number of particles in successive layers of a gamboge suspension shows that the distribution up to the region of constant concentration can be represented by an equation of the authors, which takes into account van der Waal's " b " and resolves itself into Perrin's well-known expression for low concentrations. Burton's equation (Physical Properties of Colloidal Solutions, 2nd edition, p.87), which takes into account the electric charge on the particles, also appears to fit the data, but its derivation is adversely criticised. —B. C. I. R. A.

Selenium Oxybromide. V. Lenher. Jl. Amer. Chem. Soc., 1922, **44,** 1668-1673.

The preparation and properties of selenium oxybromide are described. It is a reddish-yellow solid, m.p. 41·5°C. It dissolves benzene, toluene and xylene without chemical change, but will not mix with paraffin hydrocarbons (*e.g.*, heptane), and may therefore be used for separating such oils. The molten substance also dissolves proteins readily, such as hair, silk, leather, etc., but it is indifferent to cellulose. —B. C. I. R. A.

Activated Sugar Charcoal: Adsorption. F. E. Bartell and E. J. Miller. Jl. Amer. Chem. Soc., 1922, **44,** 1866-1880.

When activated sugar charcoal containing only a trace of ash adsorbs methylene blue from solution, the liquid is at first acid, but only remains so when adsorption is completed if larger amounts of methylene blue are employed. When methylene blue is adsorbed from solutions containing an equivalent of caustic soda, an equivalent of neutral chloride is left in solution. The charcoal adsorbs hydrochloric acid, and if the product be used for the adsorption of even small quantities of methylene blue the liquid is left acid. It is concluded that when the charcoal is introduced into methylene blue solutions the dyestuff is hydrolysed and the methylene blue hydroxide is adsorbed more rapidly and, at higher concentrations, to a greater extent than hydrochloric acid. Contact of air with the charcoal is necessary during activation, but it is not considered that the oxygen and hydrogen contents of the charcoal exercise any important influence on the phenomena. —B. C. I. R. A.

Xylan: Methylation. E. Heuser and W. Ruppel. Ber., 1922, **55,** 2084-2088.

A dimethyl derivative has been obtained by methylating xylan first with methyl sulphate and then with methyl iodide and silver oxide. This confirms the presence of two hydroxyl groups in the molecule. —B. C. I. R. A.

Polysaccharides: Constitution. P. Karrer and H. Pringsheim. Z. angew Chem., 1922, **35,** 85-90, 345-349.

Summaries of recent work on the chemistry of starch, glycogen, inulin, and cellulose. —B. C. I. R. A.

Plant Cell: Vital Staining. K. Shibata. Chem. Abstr. (from J. Orient Sci. Arts, 1921, **38,** 67-72), 1922, **16,** 1443.

A review of vital staining, precipitation and oxidation. The oxidase-like action of some complex salts of cobalt, nickel, copper, zinc, etc., on polyphenolic compounds is applied to the vital oxidation of the plant cell. For example, on dipping a piece of a plant tissue into 0·1—0·5% solution of purpureo salt, an oxidising reaction appeared in the cell sap, which changed from yellow to reddish brown or dark brown and frequently gave a granular precipitate. This reaction is observed when the cell contains a flavone compound or polyphenol, such as pyrocatechol or pyrogallol. The toxic power of cobaltammines, such as purpureo salts, is so small that a filamentous fungus can be cultivated in a solution of the salt. It is, therefore, the best reagent for vital oxidation, owing to its great power of penetration and oxidation. —B. C. I. R. A.

Light: Chemical Action. C. Winther. Chem. Zentr. (from Konig. Danske Vidensk. Meddelelser, Math.-fys. Medd., 1920, **2**, No.3, 1-35), 1922, iii, 592.

The amount of energy absorbed in the photo-oxidation of hydriodic acid is found to be identical with the amount of energy required to activate the same number of HI molecules (Marcelin's calculation). This fact, that the radiations absorbed are entirely employed in activating the molecules, has been confirmed in other cases, and is now stated as the "Law of critical activity," which is employed to explain a number of photochemical phenomena.
—B. C. I. R. A.

Plant Ash; Testing——. H. Molisch. Physiol. Abstr. (from Sitz. Akad. Wiss., Wien, Abt. 1, 1920, **129**, 261-293), 1922, **7**, 324.

The ash picture or "spodogram" is characteristic for many plants. The material to be examined is ignited in a porcelain crucible until the ash is white and the ash is then covered with a drop of aniline, phenol, or Canada balsam diluted with xylene on a microscope slide. Many cell structures are left intact after ignition. —B. C. I. R. A.

Starch; Estimation of——. H. Frankenbach. Papier Fabrikant, 1922, **20**, 1173-1178.

A review of the principal methods for the estimation of starch. Practical details are given of (1) the direct hydrolysis method (Maercker), (2) the method of decomposition by diastase and subsequent saccharification (Maercker), (3) polarimetric methods, (4) the colorimetric method (Dennstedt and Voigtländer).
—B. C. I. R. A.

Water: Hardness. E. Justin-Mueller. Jl. Soc. Chem. Ind. (from Jl. Pharm. Chim., 1922, **26**, 18-21), 1922, **41**, 644A.

The Boutron-Boudet modification of Clark's method for determining hardness is recommended, but a soap solution of only one-tenth the strength is used. The solution contains 3·5 grams of white Marseilles soap in 900 c.c. of water and is adjusted until 24 c.c. just corresponds with 40 c.c. of a 0·025% solution of calcium chloride or of a 0·059% solution of barium nitrate. —B. C. I. R. A.

Cotton Hair: Action of Light. Leipzig. Monatsch. Text. Ind., 1922, **37**, 142.

Methods have recently been devised by which the action of light on textile fibres can be estimated scientifically, and it has been shown that the cotton hair is very sensitive to light action, the breaking load of some hairs falling from 5·8 grams to 1·9 grams. Wool, flax and silk fibres were also tested. —B. C. I. R. A.

Light: Chemical Action. N. R. Dhar. Z. anorg. Chem., 1922, **122**, 151-158.

From the facts that (1) the temperature coefficients of photo-chemical reactions are reduced in light, (2) thermal reactions with high temperature coefficients are the most sensitive to light, (3) iron and uranium salts catalyse certain photochemical reactions, the conclusion is drawn that there is no fundamental difference between the mechanisms of photochemical, thermal and catalytic reactions, the radiation hypothesis being applicable in every case. Violet radiations are the most active. —B. C. I. R. A.

Furfuraldehyde: Application. C. S. Miner, J. P. Trickey and H. J. Brownlee. Chem. and Met. Eng., 1922, **27**, 299-303, 362-367.

Furfuraldehyde is now produced at a cost below that of benzaldehyde, by the distillation of suitable pentose-bearing material (*e.g.*, oat hulls; yield 20%) with 12% hydrochloric acid. It is already receiving attention in the synthetic resin, varnish, rubber, dye and anæsthetic industries, whilst it has proved to be an excellent antiseptic for glue, and solvent for nitrocellulose and hydrated cellulose acetates. A complete review and bibliography (267 references) are given. —B. C. I. R. A.

Microscopic Analysis of Fabrics. L. Hausman. Text. World, 1922, **62**, 1023-1025.

The use and disadvantages of transmitted light and the application of reflected light are discussed, and the author describes a dichromatic illumination apparatus for viewing fibres with lights of complimentary colours. This type of illumination has been found to be very successful.
—B. C. I. R. A.

Yarns; The Influence of Heat on Physical Properties of——. R. A. Truesdale. Text. Rec., 1922, **40**, 52-54.

The effect of heat on the tensile strength and elongation at break is recorded in the case of a Sakellarides yarn, 23's. In each experiment two leas were heated in a sealed chamber of 524 c.c. capacity, and then single-thread tests were made. The results show that (1) no permanent reduction in strength, and elongation, non-recoverable on re-conditioning the yarn, takes place when cotton is heated for an hour in a moist atmosphere, at below 140°C.; (2) definite signs of weakening are obtained after 1 hr. at 160°, after 3 hrs. at 147°, and after 2½ hrs. at 153°; (3) colour change (yellowing and browning) sets in at 120-140°; (4) cotton is weakened more when heated in a small vessel containing the moisture of hydration than when placed in a dry oven. Approximately comparable yarns of linen and ramie were also examined, and it was found that the loss of strength after 3 hrs. at 153° was as follows:—Cotton 47%, linen 60%, ramie 43%. —B. C. I. R. A.

Gelatin Solution: Gell Strength. E. T. Oakes and C. E. Davis. Jl. Ind. Eng. Chem., 1922, **14**, 706-710.

It is shown that the solutions of different gelatins bear the same qualitative variations for gell strength with *pH*. The form of the gell strength—*pH* curve is the same for different concentrations. The maximum for gell strength coincides in *pH* with the maximum increase in viscosity for ageing of solution. Lack of agreement between viscosity and gell strength may result from differences in the ash content of gelatin. Viscosity-gell strength measurements, properly carried out, parallel each other on different gelatins. The mean molecular weight of gelatin varies directly with the grade and is of the order of magnitude of 1,000. Additional data are submitted in favour of the gelatin-acid combination theory. The gell strength is measured by observing the load required to force a piston into the jelly to a certain depth.—B. C. I. R. A.

Cellulose: X-Ray Investigation. R. O. Herzog, W. Jancke and M. Polanyi. Zeitsch. Physik, 1920, **3**, 196-198 and 343-348.

Two papers dealing with an X-ray analysis of the "crystalline" structure of cellulose, employing the method of Debye and Scherrer. Cotton, ramie fibre, wood-fibre, artificial silk, and a viscose fibre were examined, the results obtained being almost identical in all cases. The conclusion is drawn that a rhombic crystalline structure exists in cellulose, the ratio of perpendicular axes of the elementary parallelopiped being 0·6935 :1 :0·4467.

—B. C. I. R. A.

Interferometer. R. Doerr and W. Berger. Biochem. Zeits., 1921, **123**, 144-189.

The theory of the application of the interferometer to various types of analysis is discussed. The following cases are dealt with :—The behaviour of the refraction (1) on mixing liquids which do not react, (2) on mixing liquids which do react, (3) in fermentations, (4) on mixing acids or bases with protein solutions, and the application of refractometric methods in the study of colloidal precipitations.

—B. C. I. R. A.

Gelatin; Properties of——. T. Slater Price. First Report of the Adhesives Research Committee, 1922, 51-126.

A descriptive bibliography of gelatin summarised under the following heads :—(1) Gelatin as an amphoteric electrolyte, (2) viscosity of gelatin, (3) swelling, (4) melting and freezing (setting) points of gelatin, (5) coagulation and precipitation of gelatin, (6) action of salts of heavy metals on gelatin; tanning and hardening, (7) jelly strength of gelatin.

—B. C. I. R. A.

Nephelometer. A. A. Weinberg. Biochem. Zeits., 1921, **125**, 292-310.

The newest form of Kober nephelometer is described and compared with the Kleinmann instrument. A new nephelometer is described which combines the advantages of these two instruments and, as far as possible, eliminates their errors while maintaining the same degree of accuracy. It has a constant zero point, an experimental error of ±0·5% and the readings are inversely proportional to the concentration of the suspension. A solution containing 5% Rochelle salt and 0·5% sodium carbonate is recommended for cleaning nephelometer tubes, and is also suitable for cleaning other chemical glassware. Colloid substances which cannot be obtained in a pure state can be investigated by means of this nephelometer.

—B. C. I. R. A.

Some Physical Measurements of Cotton Fibres, and their Graphical Representation. See This *Jl.* (Trans.), 1922, **13**, 220.

A Study of Flax and Kindred Fibres. II.—Further Observations on Flax (and Cotton) Fibres. Probable Relationship between "Stomata" and "Slow Spirals" of Cotton and "Dislocation Marks" of Flax. See This *Jl.* (Trans.), 1922, **13**, 213.

Some Physical Properties of Cotton Cellulose and its Modifications. A Summary of Existing Data. See This *Jl.* (Trans.), 1922, **13**, 204.

"Oxycellulose": Its Formation and Reactions. A Summary of the Literature. See This *Jl.* (Trans.), 1922, **13**, 189.

American Wooden Tank and Vat Practice. See Section 4I.

PATENTS.

Cotton and Wool Mixture: Separation. R. O. Herzog. G.P.350,638. Chem. Zentr., 1922, iv, 599.

A process for the recovery of fibres from a mixture of fibres consists in treating the teased materials with a mixture of two liquids such that each liquid will take up one kind of fibre. Thus, if a cotton and wool mixture is shaken with a mixture of water and an immiscible liquid, such as paraffin oil, carbon tetrachloride, or benzene, the wool will rise to the boundary surface of the two liquids, while the cotton sinks in the water. —B. C. I. R. A.

7.—BUILDING AND POWER.

(B)—FIRE PREVENTION.

Portland Cement as a Fire Extinguisher. Jl. Roy. Soc. Arts, 1922, **70**, 782.
A report in which attention is drawn to the remarkable efficiency of Portland cement in extinguishing fire. —L. M. S.

(D)—LUBRICATION.

The Alkali Resinates and their Applications. See Section 10.

(F)—LIGHTING.

Artificial Daylight Lamp. W. Singleton. Analyst, 1922, **47**, 424-426.
An investigation of the comparative merits of the daylight lamp in relation to the ordinary electric lamp and to natural daylight in volumetric and colorimetric analysis has shown that there is close concordance of the results obtained by the daylight lamp and by natural daylight. The daylight lamp has decided advantages over the ordinary lamp in increasing the efficiency of many chemical indicators. Observations were made of the limits of the colour range and the sharpness of the end-point of a large number of indicators by artificial daylight, natural daylight and ordinary electric light. —B. C. I. R. A.

Monochromatic Lamp. A. B. Peck. Chem. Abstr. (from Am. Mineral, 1922, **7**, 104-106), 1922, **16**, 3013.
A new type of monochromatic light source consists of a thin sheet of platinum, which is riddled with needle holes. These are filled with precipitated ammonium platinichloride and the whole is ignited, forming platinum sponge in the holes. A stiff wire is attached and the sheet is immersed in the salt of sodium, lithium or other metal employed. An intense, lasting, flame colouration is obtained. A collar mount for attaching the device to a Meker burner is described and illustrated.
—B. C. I. R. A.

Sheringham Lamp. S. H. Groom. Analyst, 1922, **47**, 419-423.
The physical principles of artificial daylight and its application in the laboratory are discussed. The transformation of artificial light to daylight is a process of eliminating rays in increasing amounts from the blue to the red end of the spectrum. The absorption of these excess rays can be carried out either by transmitting the light through a suitably-coloured screen, or by reflecting it from a coloured surface. Many units are manufactured on the former principle. The reflection method was employed for the first time in the Sheringham system in which the light from a gas-filled electric lamp is thrown upwards by means of a reflector on to the coloured interior of a shade, the under-reflector at the same time serving to prevent the escape of any uncorrected light. —B. C. I. R. A.

(H)—HUMIDIFICATION.

Factory: Humidification. W. H. Carrier. Chem. and Met. Eng., 1922, **27**, 449-452.
An analysis of the advantages which accrue from the use of humidified air-ventilating systems, principally with reference to the efficiency of the individual worker. —B. C. I. R. A.

9.—COMMERCE, ECONOMICS, LABOUR, ORGANISATION, COSTING, &c.

Switzerland's Silk Trade. Ch. of Comm. Jl., 1922, **44**, 134.
During the first half of 1922 the exports amounted to 813,000 kg., valued at 83,780,000 francs, compared with 760,300 kg. at 91,661,000 francs in the first half of 1921. For the first six months of 1922 the imports of raw silk were nearly double, and those of artificial silk seven times, those of the corresponding period of 1921.
—F. G. P.

Roumania: Cotton Textile Industry and Hemp Cultivation. Bd. of Trade Jl., 1922, **109**, 350.
The Commercial Secretary to H.M. Legation at Bucharest has forwarded a copy of "Correspondance Economique," which contains a lengthy and exhaustive article on the situation of the textile industry and on the culture of hemp in Roumania. Details are given of the quantities and nature of the various cloths required by the Roumanian Government during the financial year 1923. The total of these requirements is estimated at close upon 5 million metres, costing practically 146 million francs. The article, which is in French, may be consulted at the Dept. of Overseas Trade, 35, Old Queen Street, London, S.W.1. —L. M. S.

Egypt: False Folding and Markings of Cotton Textiles. M/c. Ch. of Comm. Monthly Record, 1922, **33**, 293.
The text of the letter and memorandum drawn up by the Egypt Executive and the Trade and Merchandise Marks (Statutory) Committee, with the suggested amendments, additions and deletions made by the Board of the Chamber of Commerce, on the decree issued by the Egyptian Government on the 15th June, 1922, to prevent the importation into that country of goods falsely folded or marked.
—L. M. S.

Vocational Guidance in Foreign Countries. G. H. Miles. Jl. Nat. Inst. Ind. Psychology, 1922, **1**, 152.
In continuation of the previous article (This *Jl.* Abs., 1922, **13**, 192) the methods adopted by the various universities, institutes and schools of the United States are outlined. The need for a co-ordination of the whole of the work is emphasised.
—L. M. S.

B.A.W.R.A. Wool: Stocks and Disposals. Bd. of Trade Jl., 1922, **109**, 323.

Stocks and disposals January-August, 1922. —L. M. S.

Breakage Problems; An Investigation into——. G. H. Miles and A. B. B. Eyre. Jl. Nat. Inst. Ind. Psychology, 1922, **1**, 132.

The inadequacy of attributing breakages to carelessness, accidents, or poor material is illustrated. By treating the subject from a psychological standpoint, an enormous reduction in breakages has been effected, amounting to over 75% in the case of certain articles. The gas consumption in one department has been reduced by 50%. —L. M. S.

U.S.A.: Increased Raw Silk Imports. Bd. of Trade Jl., 1922, **109**, 350.

According to the "Trade Record" of the National City Bank of New York 48,179,000 lbs. of "raw silk reeled from the cocoon" were imported in the fiscal year ending June, 1922. The previous highest record was 47,127,000 lbs. in 1920. The value of the unmanufactured silk imported, including raw silk in skeins, waste and cocoons, was 307,283,000 dollars in the fiscal year 1922 and 190,320,000 dollars in 1921. The total value of the silk manufactures exported from the States in the fiscal year 1922, whilst materially less than in the immediately preceding years, amounted to over 10 million dollars, as compared with 2,400,000 dollars in 1913. —L. M. S.

Welfare Work in Indian Mills and Factories. G. M. Broughton. Jl. Indian Industries and Labour, 1922, **2**, 345.

International Cotton Bulletin. See This *Jl.* (Proc.), 1922, **13**, 163.

A Field for the Inventor: [Crossbred Wools]. See This *Jl.* (Proc.), 1922, **13**, 161.

10.—MISCELLANEOUS.

The Alkali Resinates and their Applications. Chem. Trade Jl., 1922, **71**, 159, 289, 383.

To increase the tensile strength of nitrocellulose artificial silk threads and also to reduce their inflammability there is added to the cellulose, before solution, 20% of zinc or magnesium resinate. The addition of a larger proportion of resinate leads to the production of hard products resembling celluloid. The use of zinc or magnesium resinate renders viscose silks perfectly impermeable to water. The addition of zinc resinate containing 8% of zinc oxide allows of artificial silks being washed with soda and soap, but in order not to damage the softness of the fibre it is best not to add more than 20% of resinate on the weight of the silk. Alkali resinates have been employed, under the name of rosin soap, in certain preparations for the partial or total replacement of linseed oil for lubricants, etc. Organic dyestuff lakes with a resinate base are obtained by precipitating a basic dyestuff with a metallic resinate and using as substrata zinc or aluminium resinates. —L. M. S.

Cloth Moth. E. Titschack. Chem. Zentr. (from Z. Techn. Biologie, 1922, **10**, 1-168), 1922, iii, 945-947.

A very exhaustive study of the life history, habits and physiology of the common clothes moth *Tineola biselliella* Hum. The influence of chemicals in the gaseous, liquid and solid state, and of temperature, light, moisture and dryness on the moth at different stages of its life history has been investigated. Material free from keratin such as cotton, is only eaten under the compulsion of hunger. Fats have no significance whatever in the development of the maggot. Starch and cellulose are not digested. The fully grown maggot consists of 58% dry material and increases about 300 times in weight during life. Methods for combating the moth are described, including the use of eulan, in the search for which the present investigation was undertaken. —B. C. I. R. A.

ABSTRACTS

I.—FIBRES AND THEIR PRODUCTION.

(A)—MINERAL.

Asbestos. Bull. Imp. Inst., 1922, **20**, 242.
Two new discoveries of asbestos are being opened up in Western Australia, one form of which is chrysotile, a large proportion of the fibre being up to 1½ in. in length, and some reaching 4 in. Extensive discoveries of asbestos fibre seams have also been reported from Rhodesia, and the fibre is of exceptionally fine quality. Approximate figures are given for the total output of raw asbestos for the years 1909, 1913, 1916, 1918-20. —L. M. S.

Asbestos: Resources of Canada. Bd. of Trade Jl., 1922, **109**, 485.
A general article dealing with the occurrence, varieties and uses of asbestos. —L. M. S.

Asbestos-Cotton Mixture; Analysis of——. See Section 6.

(B)—ANIMAL.

Industries of Shantung Province. Bd. of Trade Jl., 1922, **109**, 320.
The silk industry is progressing, and growers are studying the Chekiang methods of breeding. There are 50 filatures in the district, producing 250,000 catties of silk. Improved looms are being imported. —F. G. P.

The Influence of the Incubation Temperature upon the Retention of the Bivoltine Character. A. Mollo. Bull. Agric. Intell. (from Informazioni Seriche, 1921, **8**, 257-259), 1921, **12**, 1603.
Bivoltism is retained by incubation at 18°C. It is less certain that this character is lost by raising the incubation temperature to 25°C., for probably other factors also come into play. The moths that emerged latest from the cocoons in the rearings from eggs incubated at 25°C. laid non-bivoltine eggs. It has also been ascertained that bivoltine eggs become coloured 2 or 3 days only before hatching, while those that have lost the bivoltine character assume a violet-grey hue 3 days earlier. —L. M. S.

Silk Producing Insects of San Salvador: "Eutachyptera psidii" and "Rothschildia jorullo." S. Calderon. Bull. Agric. Intell. (from Revista de Agricultura Tropical, 1921, **1**, 9-14), 1921, **12**, 1602.
The Lasciocampid, *Eutachyptera psidii* Salle and the Attacid, *Rothschildia jorullo* Westw. are mentioned as capable of attaining a certain economic importance. —L. M. S.

The Possibilities of Rearing the Eri Silkworm "Attacus ricini" in Egypt. E. W. Adair. Bull. Agric. Intell. (from Bull. entomologique d'Egypte, 1921, **13**, 101-103), 1922, **13**, 114.
Experiments in silkworm breeding on a small scale have proved that the work can be carried on throughout the year in the region of the Delta, and during the winter months in Assuan. It will be necessary to rear silkworms on a large scale in Nubia during the winter and on a small scale in Cairo during the summer, in order to obtain eggs for the following winter, as eggs of *Attacus ricini*, unlike those of *Bombyx mori*, cannot be kept from one season to another. Tables are given showing the average number of days necessary for development at different stages and seasons (egg 10-20 days, larva 20-82 days, cocoon 19-48 days); the average weight of 100 cocoons (from 39-50 gram.); and the number of cocoons per kg. (from 2,000—4,000). —L. M. S.

Silkworm Breeding in Tripolitania. Bull. Agric. Intell. (from Bollettino di Informazioni, 1921, **9**, 277), 1922, **13**, 113.
It is possible to have two rearings of silkworms a year in Tripolitania; special rooms built partly below the level of the ground are not necessary. The high temperatures due to the "ghibli" do not hinder the growth of the spring broods. The natives in the Tripoli oases are not at present very interested in silkworm breeding, but it is hoped that the industry will become important. —L. M. S.

Colombia: Development of the Silk Industry. Bd. of Trade Jl., 1922, **109**, 499.
Other departments besides Santander and Norte de Santander are now taking an interest in the industry. The Department of Cundinamarca has recently taken active steps to introduce it, and a School of Sericulture is reported in the Department of Cauca. The mulberry tree has already been cultivated with great success in the country, and the production will be more or less constant and not seasonal. —L. M. S.

Wool Constitution: Dyeing of Amino Groups. See Section 4I.

B.A.W.R.A. Wool: Stocks and Disposals. See Section 9.

(C)—VEGETABLE.

Insects Injurious to the Cotton Plant in Brazil. L. de Freitas Machado. Bull. Agric. Intell. (from Lavoura e Criacao, 1921, **6**, 189), 1921, **12**, 1652.
A list is given of insects which have, up to the present, been recorded as injurious. —B. C. I. R. A.

Russia: Flax Crop. Bd. of Trade Jl., 1922, **109**, 469.

According to the reports of the "Linotorg" (the Government trust appointed to collect and export flax) the total crop this year is estimated to be from 144 to 162½ million lbs. As approximately 90 million lbs. are required for home industry, only the balance of 36 to 54 million lbs. will be available for export. —L. M. S.

Fibres; Cultivation of——in Argentina. B. G. Navarro. Bot. Abstr. (from Bol. Ministeric Agric. Nacion, Argentina, 1921, **25**, 499-522), 1922, **10**, 227.

A paper on the textile industry in the northern territories of Argentina discussing the textile needs of the country and the prospects of obtaining home-grown supplies. Details of the long-staple cotton growing industry in the U.S.A. and of the sisal industry of Yucatan are given, and certain indigenous fibre-yielding plants are described. —B. C. I. R. A.

Experimental Researches on Vegetable Assimilation and Respiration. XVI. The Characteristics of Sub-Normal Photosynthetic Activity Resulting from Deficiency of Nutrient Salts. G. E. Briggs. Proc. Roy. Soc., 1922, **B.94**, No. B.656, 20-35.

The photosynthetic activity of plants of *Phaseolus vulgaris* grown on culture solutions devoid of potassium, magnesium, iron, or phosphorous is less than that of plants grown on full culture solutions. The activity is depressed in the same way on reducing light as when reducing temperature. The activity is also below normal when carbon dioxide is reduced. The amount of "active chloroplast surface" in the leaf is supposed to be the determining factor in the processes considered. —L. I. R. A.

Cotton from Tanganyika. Bull. Imp. Inst., 1922, **20**, 141-146.

The results of the examination of a number of cottons produced in different regions of Tanganyika are recorded. Cottons from the Morogoro and Mwanza districts appear to have been derived from a deteriorated form of a long-stapled type. The variation in length and strength was very pronounced, and there was much stained and immature fibre. These cottons could be improved by careful seed selection. Cottons from the Rufifi district were generally superior to the above but similar in type, being soft and lustrous and exhibiting considerable variation in length. If the varieties of these cottons examined were submitted to careful selection cotton of excellent quality, readily saleable at good prices, could probably be produced. If cottons from the Lindi district were submitted to selection experiments there seems no doubt that a valuable type of cotton could be established which would furnish a crop of excellent cotton well suited to the requirements of the Lancashire market. —B. C. I. R. A.

"Colletotrichum Agaves," a Deuteromycete Injurious to "Agave" spp. in Indo-China, the French Sudan, and France. A. Chevalier. Bull. Agric. Intell. (from Rev. de Botanique appliquée, 1921, **1**, 21-23), 1921, **12**, 1347.

The fungus has been recorded as attacking *A. rigida*, *A. Americana*, *A. Salmiana* and their variegated forms. Specimens of *A. applanata* growing amongst the preceding species were not infected. The disease shows itself in the form of a small brown spot, that gradually increases in size, finally attaining the diameter of 3·4 cm. Very badly infected leaves are wholly useless. Control measures are suggested. —L. M. S.

Relation of Cultivation of Abaca ("Musa textilis") to Climatic Conditions in the Philippines. S. P. Rosales. Bull. Agric. Intell. (from The Philippine Agriculturist, 1921, **9**, 219-237), 1921, **12**, 1514.

Three types of climate can be distinguished in these islands, and are considered in relation to their suitability to the growth and development of *Musa textilis*. —L. M. S.

Pink Bollworm Recorded for the First Time in Porto Rico. J. F. Legrand. Bull. Agric. Intell. (from Revista de Agricultura de Puerto Rico, 1921, **7**, 9-13), 1921, **12**, 1652.

The pink bollworm has been found in the Humacao district of Porto Rico. Further researches have revealed its presence in the neighbourhood of Arecibo, Hatillo, Camuy, Quebradillas and Isabela. The author gives information as to the geographical distribution of the insect, its life-history, and the means adopted for combating it. —B. C. I. R. A.

Cotton Pests and Diseases in British Colonies and India; Regulations regarding——. Bull. Imp. Inst., 1922, **20**, 192-207.

A general account of the regulations regarding cotton pests and diseases in India, Uganda, Anglo-Egyptian Sudan, Nigeria, Gold Coast, West Indies, Nyasaland and Rhodesia, Union of South Africa, East Africa, Tanganyika, and other countries of the Empire. —B. C. I. R. A.

Cotton Growing in Natal: Records of Recent Trials. W. B. Wilson. Bull. Agric. Intell. (from Farmer's Weekly, 1921, **21**, 1178-1179), 1921, **12**, 1147-1148.

Production has been considerably increased over the whole of Natal in the last few years, but marketing the crop is a serious question which still remains to be solved. Long-stapled American Upland varieties have proved to be the most suitable for the conditions, whilst all attempts at ratooning, irrespective of the variety or class of cotton, have resulted in failure. The cotton thrives best on the rich soils of the low, hot valleys and the best soils of the coastal belt, but not too near the sea and in exposed positions.

—B. C. I. R. A.

Cotton Cultivation in French West Africa. Text. Merc., 1922, **67**, xxi.

French West Africa is admirably suited, by its geographical position, its climate, the nature of its soil, and the character of its rivers for the cultivation of American and Egyptian cotton. The native varieties of cotton are not capable of improvement to any considerable extent. Economic conditions are not very favourable. Attention is being given to the necessary improvement of irrigation. —B. C. I. R. A.

Trials of New Varieties of Cereals. I. and II. E. S. Beaven. Jl. Min. Agric., 1922, **29**, 337-347 and 436-444.

In Part I. of the article the author discusses the limitations of yield testing and the significance of probable errors in field trials. Describes methods of laying out chess-board nursery plots by which the probable error is kept low. In Part II. the value of the "Half-Drill-Strip" method of laying out plots and the small probable error that is found to occur is discussed. —L. I. R. A.

Cotton Cultivation in Mozambique. Bull. Imp. Inst., 1922, **19**, 447-452.

A short account of the history of the industry. Cotton cultivation has now been extended to the interior districts, away from the river margin, and excellent cotton is being produced throughout the district of Chemba. Seed is distributed free to native growers, and cultivation is carried on under supervision. A description is given of three samples of lint and eight samples of seed-cotton grown in Mozambique territory. —B. C. I. R. A.

Cotton Cultivation in Nigeria. P. H. Lamb. Bull. Imp. Inst., 1922, **19**, 469-474.

The author discusses the present position and prospects of cotton growing in the northern provinces. Indigenous varieties were found to be of poor quality, but a strain of "Allen's Long Staple Upland" has been acclimatised and gives good results. The question as to whether the native will adopt cotton cultivation on an increasing scale is shown to be purely an economic one. —B. C. I. R. A.

Pink Boll-Worm; Machines for Treating Cotton Seed Against the——. A. I. Ghesquière. Bull. Agric. Intell. (from Annales de Gembloux, 1921, **17**, 234-238), 1921, **12**, 1473-1475.

Some notes on publications dealing with control measures adopted against the pink boll-worm and describing machines for disinfecting cotton seed against the pest. These can be classed broadly as (1) fumigating machines using carbon disulphide or hydrocyanic acid, (2) machines using a current of hot air, acting by radiation, or by direct contact with heated metal plates. This last type includes the Simon and the Macri machines. —B. C. I. R. A.

Flax Breeding; Contributions to——. R. Fleischmann. Z. f. Pflanzenzucht, 1921, **8**, 26-43.

Certain results in practical fibre-flax breeding are detailed relative to variation, correlation, and inheritance of stem length. Breeding material was taken from fields in two districts of Hungary. The branched portion of the flax plant showed greater variability than the lower, unbranched portion. The author concludes that clearer, more accurate results were obtained by limiting the study to the unbranched part of the stem. Intensity of inheritance was measured by the coefficient of correlation of length of stem from one generation to the next. This coefficient was generally high, but varied according to weather conditions. (Two crops were raised each season.) Inheritance of stem length was as pronounced with selected lines as in general, unselected stock. In series of selected lines showing decrease in stem length, the standard deviation was found also to decrease coincident with approach to a symmetrical type of curve. Skewness decreased as mean length diminished; this did not hold true in mixed populations. Absolute decrease of stem length, brought about by weather conditions, was relatively greater in selected lines of maximum stem length; results of this character were less marked in unselected stock. Hot, moist weather in the second half of 1920 decidedly increased the coefficient of variation. Stem length was not significantly increased, but flowers and bolls were markedly increased and also basal branches. Selection of stem length within (presumably) pure lines showed no significant influence. —L. I. R. A.

Cotton Crop; Forecasting the American—. J. B. Kincer. Bull. Agric. Intell. (from Monthly Weather Review, 1921, **49**, 295-299), 1921, **12**, 1372-1376.

A statistical treatment of the reports issued by the Bureau of Census on the harvest or ginning of the cotton crop and the final report, showing the total production is employed to establish:—(1) The relation between the weather condition and the amount of cotton ginned between November 1st and December 1st, and (2) the relation between the cotton ginned up to the end of November and the total output. The calculations are made with reference to the 15-year period 1905-1919 and concern the ten cotton belt States. The possibility of forecasting the total yield of cotton from weather records in November is clearly demonstrated. —B. C. I. R. A.

Cotton; Ginning——. W. Whittam. Canad. Text. Jl., 1922, **39**, 407-408.

The loss due to the present wasteful methods of saw ginning is discussed, and the author emphasises the importance of improving the existing type of saw gin or modifying it very considerably. References are made to new gins, including one with smooth needles instead of saw teeth. —B. C. I. R. A.

Discovery of a Wild Cotton, "Bassia lanuginosa," in Western Queensland. C. T. White. Bull. Agric. Intell. (from Queensland Agric. Jl., 1921, **15**, 216-218), 1921, **12**, 1148-1149.

Specimens of a wild cotton plant found on poor sandstone hills in Western Queensland proved to belong to a species of *Bassia* apparently new to science, the nearest allied plant known being *B. carnosa*. The cotton surrounding the seed of the new species is, however, considerably longer. A description of the plant, which is designated *B. lanuginosa*, is given. Owing to its short staple its commercial value is doubtful, though it might be used as a substitute for kapok. —B. C. I. R. A.

Linen Industry; The——. F. Bradbury. Text. Rec., 1922, **40**, No.475, 49-51.

The author deals with the flax supply during the last few years, and shows how efforts have been made to increase and encourage the cultivation, handling, yield, and quality. Reference is made to the improvements which have been effected in the pulling and breaking and scutching operations and to the work which is being carried on at the Research Institute, Lambeg. —L. I. R. A.

Flax Machinery. Bull. Imp. Inst., 1922, **20**, 207-216.

A description is given of the following flax machines which are at present on the market:—Fibre Corporation Pulling Machine, Fibre Corporation Deseeding Machine, the "Boby" Automatic Combined Flax Breaking and Scutching Machine, and the Speedo Flax Scutching Machine, patented by the Fibre Corporation, Ltd. —L. I. R. A.

(D)—ARTIFICIAL.

Artificial Silk; Manufacture of——. R. Furness. Chem. Age, 1922, **7**, 522-524.

A review of the various processes. The value of thiocyanates as solvents for cellulose is discussed, and a new process of artificial silk manufacture, based on the use of calcium thiocyanate, is foreshadowed. —B. C. I. R. A.

Artificial Silk in Italy. Jl. Roy. Soc. Arts, 1922, **70**, 842.

The Italian artificial silk industry is a comparatively new one, but four different systems are now in use for the production of fibre from wood pulp. Some of the raw materials used are produced by native industries, and it is hoped that after a time the wood pulp may be also, though at present it is imported principally from Scandinavia. Considerable quantities of cloth, hosiery and knitted goods are being manufactured from the fibre.—L. M. S.

Artificial Silk; Manufacture of——. Textilberichte (from Monit. Maille, 1922, 591), 1922, **3**, 354.

Solution of the cellulose is facilitated if it is converted into hydrocellulose by treating it with hydrochloric acid or with dilute sulphuric acid (1—2%) at a high temperature. Better results are obtained if mechanical wood pulp is employed. —B. C. I. R. A.

The Development and Future of the Production of Artificial Filaments for the Textile Industry. See This *Jl.* (Proc.), 1922, **13**, 167.

Artificial Silk; The Cylindricity of——. See Section 6.

PATENTS

Cellulose and other Carbohydrate Ethers; Artificial Threads, etc. G. Young, London. E.P.184,825, 31/8/22.

General details are given for the preparation of alkyl ethers of various celluloses and carbohydrates of the general formula $(C_6H_{10}O_5)n$, which are characterised by their insolubility in alcohol, benzene, and water. Cellulose 2 parts, caustic alkali 2—3 parts, and water 1—1½ parts, are autoclaved with a large excess of the appropriate alkyl chloride, or mixture of alkyl chlorides, preferably in presence of copper powder as catalyst. An inert organic diluent such as benzene may also be added, and the mixture should be agitated during the reaction. The products may be employed in the manufacture of artificial threads, etc. —T. K. W.

Viscose: Artificial Threads. W. Cross, London (Technochemia Akt.-Ges; Garus, Switzerland). E.P.185,433, 4/9/22.

The cellulose is subjected to a preliminary treatment with acid, under conditions specified, so as to avoid production of hydrocellulose, considerably smaller proportions of caustic alkali and carbon disulphide then being required in viscose manufacture. The viscose solution, also, can be spun without ripening to give lustrous and strong threads, whilst in the case of unbleached cellulose the brown dyestuff remaining in the threads acts as a mordant when the threads are dyed. Spec. 4713/96 is referred to. —A.

Hydra-Oxy-Cellulose Xanthate. C. C. L. G. Budde. E.P.184,610, 24/8/22.

By treating cellulosic material containing one-half to twice its weight of water, first with chlorine gas in sufficient excess to react with the non-cellulose matter and convert the cellulose into oxy-cellulose, and then with strong hydrochloric acid, a hydra-oxy-cellulose is obtained. This substance gives a xanthate which readily mixes with water; a solution containing 20% of hydra-oxy-cellulose will spread itself evenly and rapidly over a flat surface. The xanthate can be used for the manufacture of artificial silk, paper size, leather boards, etc. The process of manufacture is described. —B. C. I. R. A.

Mixed-fibre Textile Materials. A. G. Bloxam, London. E.P.185,238, 4/9/22.
Animal fibres treated with an oxidizing agent and an alkali, as described in Spec. 183,249 and 183,270, and mixed with artificial cellulose fibres, yield a material having the appearance of being made of one kind of fibre, a character which persists after dyeing. —A.

Machine for Harvesting Flax. C. A. Choate, Calgary, Alberta. U.S.P. 1,431,372, 10/10/22; Appl., 9/12/20.
A harvester combining conveying and elevating device receiving motion from the travelling wheels, and a tension roller with rolling members mounted angularly and adapted to pass the flax and comb it between the tension roller and the bottom of the rolling numbers of the reel. —A.

2.—CONVERSION OF FIBRES INTO FINISHED YARNS.

(A)—PREPARATORY PROCESSES.

Cotton; Opening of——. K. Moller. Text. World, 1922, 62, 2013-2015.
Discussing possible developments in cotton manufacture, the author states that he has seen very fair cotton yarn made with only an opener, a card and a spinning frame, and good cotton yarn made with a vertical opener, a card, a slubber and a spinning frame. In one plant, two Creighton openers furnish cotton sufficiently clean and open to put directly on the card provided it is intended for coarse work, and experiments appear to indicate that a mill employing only two or three vertical openers, a card, a slubber and a spinning frame would be practicable if a satisfactory hopper feeder could be designed for the cards. The only function of the scutcher is to make the cotton into a convenient lap. —B. C. I. R. A.

Pneumatic Card Feeder. Text. Rec., 1922, 40, No.475, 177-199.
An illustrated account of a pneumatic card feeder which delivers a fleece of cotton from the scutcher lap direct to the finisher card, thereby eliminating the breaker card which is suspected of damaging the cotton. —B. C. I. R. A.

Tunstall Combing Machine. Text. Rec., 1922, 40, No.475, 141.
An illustrated description of the Tunstall combing machine. The machine is double-sided, the two sides being interdependent, has six heads on each side and delivers the combed slivers into two coilers. —B. C. I. R. A.

Cotton Carding; Some Aspects of——. R. Norris. Text. Merc., 1922, 67, 353.
The lecturer discusses the precautions which must be taken to ensure efficient carding and absence of neps. —B. C. I. R. A.

Cotton Mixing. R. Dycke. Leipzig. Monats. Text. Ind., 1922, 37, 128-129.
The author discusses the question of cotton mixing in general and describes a typical modern mixing plant. —B. C. I. R. A.

Youlten Opener. Text. Rec., 1922, 40, No.475, 165.
A detailed, illustrated description of the Youlten cotton opener. —B. C. I. R. A.

Cotton Spinning. See Section 2B.

(B)—SPINNING AND DOUBLING.

High-Draft Mechanism. E. D. Walen. Text. World, 1922, 62, 2015-2017.
It is shown that the present system of drafting produces an uneven product due to lack of sufficient fibre control. Attempts have been made by light-weight middle rolls and belts to increase the proportion of fibres controlled. The advantages and disadvantages of the Casablancas, Gibello-Palazzo, Cesoni-Lerusse and Gilardoni long-draft systems are compared. —B. C. I. R. A.

Cotton Spinning. W. Scott Taggart. Text. Rec., 1922, 40, No.475, 45.
Some future possibilities in cotton spinning processes, especially mixing and carding, and in mill organisation, are discussed. —B. C. I. R. A.

"Climax" Twisting and Winding Frame. Text. Rec., 1922, 40, No.475, 211.
An illustrated description of the "Climax" patent combined twisting and winding frame. It is claimed that this machine will twist or double any class of yarn of two or more ends, with any predetermined number of turns per inch. Subsequently the twisted yarn is wound in cheese form on to tubes or double-flanged bobbins. Twisting and winding take place simultaneously. —B. C. I. R. A.

The Driving of Spinning Frames: The Weilding Clutch. Text. Merc., 1922, 67, 323.
An illustrated description of the Weilding patent friction clutch designed to prevent the fraying of ropes and too great an acceleration at starting up in the driving of spinning frames by ropes. —B. C. I. R. A.

Yarn: Twist. F. Keller. Textilberichte, 1922, 3, 343-344.
The twist put into yarn depends on the fineness of the yarn, the fibre length of the cotton employed, and the purposes for which the yarn is required. A table is reproduced showing the appropriate twists per inch for warp yarn, weft yarn, doubled yarn and hosiery yarn. A device is described for removing excess twist from hard twisted yarns. The yarn coming from the cop is passed over a hook which, as it turns, causes the thread to wind itself round a centre axis, thus applying tension. The yarn is meanwhile twisted in the opposite direction to that of the twist put in. —B. C. I. R. A.

France: Activity of Cotton Spinning Industry. See Section 9.

(D)—YARNS AND CORDS.

Yarn: Twist. See Section 2B.

PATENTS

Fixing the Pins in Gills. A. Alleman. F.P.530,474; Appl., 2/2/21.

One or more grooves are bored longitudinally in the hollowed body of the gills and the pins are laid in transversely bored holes, fixed with solder and maintained by perforated rims in combination with the grooves and holes filled with solder. The holes are bored at various diameters and cross the gill on both sides if one groove is used, or where there are two grooves, the hole for the pin has the same diameter and the pin lies on the inferior rim of the hollowed body of the gill. —Bur. Text.

Spinning. F. Casablancas, Barcelona. E.P.185,733; Conv., 10/9/21.

Relates to a drawing mechanism comprising a false-twist device arranged between two drawing-sets, both of which may be provided with feeding devices separated from the corresponding drawing-rollers by a distance which is less than the mean length of the fibres and in which the peripheral speed of the feeding devices of the second set is sensibly greater than the speed of the drawing cylinders of the first set so as to produce a drawing of the roving while it is being subjected to the false twist. —A.

Spinning: Spindles. Vajda and Co., Charlottenburg, Berlin. E.P.185,393; Conv., 27/8/21.

Relates to spindle bearings and comprises collar and footstep bearings constructed so as to yield in every direction. —A.

Spinning Machines. Platt Bros. and Co., and H. P. Hall, Oldham. E.P.185,246, 7/9/22.

The head of a tin roller is connected to its arbor by means of a sleeve. The sleeve and arbor are formed with corresponding rabbets which receive a clamping plate, the latter being fastened by set-screws to the sleeve to secure the arbor and tin roller head rigidly together. —A.

Spinning. W. and N. Whitehead, of Spofforth, and C. Smith and E. W. Varley, of Bradford. E.P.184,922, 31/8/22.

An electric stop-motion for roving and like machines. —A.

Disintegrating Waste Textile Material. O. Johannsen, Christiania. E.P.184,867, 21/8/22.

In a machine for making fibrous waste from rags, etc., the material is carried by an endless belt to serrated feed-rolls, which deliver it to a small picking-drum, whence it passes to a large picking-drum and is severed into single threads. —A.

Preparing Fibres for Spinning. R. E. Fletcher and A. Birch, Bolton. E.P. 184,842, 23/8/22.

Lap-forming apparatus in which, in a combined draw and lap machine, the laps are mounted transversely in the machine in two batches. The laps are passed through drawing rollers and through guide rollers to a single curved guide-plate which passes the combined lap to the lap machine. —A.

Spinning. E. A. Wilman, Pudsey. E.P. 184,829, 22/8/22.

Refers to provision means for placing broken ends in contact with spindles, etc., in spinning, twisting, winding and like machines. —A.

Spinning and Winding Machine. R. L. Duke, Columbus, Ga. U.S.P.1,433,347, 24/10/22; Appl., 29/7/21.

The combination with traverse mechanism and builder mechanism co-operable therewith, of a locking device for the traverse mechanism during the formation of bunches, a longitudinally movable bar, and cam means operable by the builder mechanism to move the bar and withdraw the locking device from locked relation relatively to the traverse mechanism.—A.

3.—CONVERSION OF YARNS INTO FABRICS.

(B)—SIZING.

Sizing Problems. P. Bean. Text. Rec., 1922, **40**, No.475, 85, 112.

The mixing of light and heavy sizing mixtures is considered. The importance of always working according to a definite and invariable system in making a given mixture is emphasised, and the part played by the experience of the operatives is discussed. In the case of heavy mixings a prolonged and thorough agitation is necessary. The difficult problem of treating coloured yarns receives attention with special reference to the avoidance of mildew. In conclusion, the question of oil-stains receives a brief mention. Mineral oils are to be avoided. The manufacturer should simply mark oil stains for the bleacher or else saturate them with olive oil. —L. I. R. A.

Paraffin Wax; Application of——. M. Fort. Jl. Soc. Dyers and Colorists, 1922, **38**, 250-251.

Contrary to the statement of Higgins and Hodge (This *Jl.* Proc., 1922, **13**, 87), manufacturers run no risk by using paraffin wax, either in sizing, bars, or by hand application on the loom, provided the cloth is submitted to solvent extraction of the type previously described (This *Jl.*, 1921, **12**, 122, and E.P. 137,968, This *Jl.*, 1920, **11**, 149). The removal of paraffin and natural waxes is complete by this process, and less damage is done to the cloth than by any known system of boiling with alkalis. The author believes that paraffin may be considered as a legitimate sizing material. —B. C. I. R. A.

Starch; Testing——. See Section 6.

Temperature Regulator. See Section 10.

(C)—WEAVING.

Warper Cleaning Device. Text. World, 1922, **62**, 2025.
An automatic cleaning device for preventing the accumulation of fly on the combs and drop wires of warpers is described. The device consists of an electric fan, arranged to blow downwards, which travels lengthwise across the machine and at the same time oscillates from the front to the back, so that the air current passes through the dents of the front comb and also through the drop wires and dents of the back comb. —B. C. I. R. A.

Loom Motors; Efficiency of——. C. Manlik. Textilberichte, 1922, **3**, 343.
The author recommends that the efficiency of motors used to drive looms should be tested periodically in order to determine the point at which it would be more economical to replace the old motor by a new one. —B. C. I. R. A.

Loom Construction. P. List. Textilberichte, 1922, **3**, 341-343.
A technical discussion of the construction and setting of the frame, shed mechanism, and picker mechanism of power looms. —B. C. I. R. A.

Loom Design. Text. Rec., 1922, **40**, No.475, 55.
Some possible improvements in the loom are discussed. —B. C. I. R. A.

Long Chain Beaming of Cotton Warps. C. Herdegen. Text. World, 1922, **62**, 2015.
A comprehensive discussion of the cause of defects arising in the long chain beaming of cotton warps and in handling bleached, dyed or mercerised yarns. An attachment which facilitates the splitting of dyed warps and a convenient device for taking care of the extra ends and reserving the yarn for piecing up are illustrated. —B. C. I. R. A.

Automatic Loom. Text. Rec., 1922, **40**, No.475, 247.
An illustrated description of an automatic weft-replenishing loom designed to weave ginghams or checks and provided with four shuttle boxes and a magazine which carries the pirns of weft, dyed in the four colours used. —B. C. I. R. A.

(D)—KNITTING.

Knitting Loom. Text. Rec., 1922, **40**, No.475, 157.
The advantages of a latch needle loom, which the makers claim is superior to imported looms of the same type, are discussed. —B. C. I. R. A.

Knitting Machinery. J. Chamberlain. Text. Rec., 1922, **40**, No.475, 59.
The author reviews the present position of knitting machinery manufacture. —B. C. I. R. A.

Raschel Machine. R. Fabian. Textilberichte, 1922, **3**, 264, 283, 302, 344.
The Raschel machine is a "knitting loom" in which the needles work in a vertical direction. A complete account of the development and mechanism of these machines is given. —B. C. I. R. A.

(E)—LACEMAKING AND EMBROIDERING.

Embroidery and Drawn Work Industry of the Canary Islands. Jl. Roy. Soc. Arts, 1922, **70**, 855.
There is a constant, though small, demand for Teneriffe embroidery. Local statistics show that 113,955 lbs. of embroideries, drawn work and lace were shipped to 15 countries in 1920. The cloth used ranges from all-cotton to cotton and linen, pure linen, and silk. Barcelona supplies most of the cotton cloth; the cotton-linen, all-linen, and silk cloths largely come from Great Britain. Cotton thread is used, and is brought from Barcelona, Great Britain and Mulhouse. —L. M. S.

PATENTS.

Winding Frames; Improvements in the Thread-Guide in—. Niepee et Fetterer. F.P.530,377; Appl., 29/1/21.
A device for obtaining a very high speed in winding yarns. The thread-guide is made in steel plate, hammered even, chased, and then hardened and cemented. The thread-guides are united by a rod, which latter can be very light. A cam suffices to move two opposite series, each of which carries two thread-guides. —Bur. Text.

Electrical Warp Stop-Motion. M. Bourgeois. F.P.529,784; Appl., 13/1/21.
Comprises a metallic frame, including the warp stop-motion with spring elements constituted by the right metallic wires, the ends of which are bent in the form of a hook. The hooks of adjacent elements are alternated, the elements being crossed between them in parallel planes, so that they cannot be entangled. The right ends of the elements are secured between bands in the intercalary spaces; a disposition of the removable reeds between the bands conserves the parallelism. —Bur. Text.

Improvements to Jacquards. L. Leclercq. F.P.528,922; Appl., 22/12/20.
In the Delerue jacquard system a ring, of pig-iron or bronze, is fixed on the handle bearing the main wheel and moves the rod coupled to the slay. This ring is excentric. —Bur. Text.

Knitting Machines. O. F. C. Kunau, Buffalo, New York, U.S.A. E.P.185,158, 28/8/22.
A rib machine is provided with means for readily adapting it for the production of tubular work of different diameters. —A.

Apparatus for Preventing Lateral Contraction of a Fabric during Weaving. F. Boyer, Paris, France. U.S.P. 1,433,256, 24/10/22; Appl., 26/11/20.

Comprises rotary devices co-acting with the shuttle for laying the weft in a serpentine path at the bottom of the shed.—A.

4.—CHEMICAL AND OTHER PROCESSES.

(B)—SCOURING AND DEGUMMING.

Temperature Regulator. See Section 10.

(E)—DRYING AND CONDITIONING.

Magnesium Perchlorate as a Drying Agent. H. H. Willard and G. F. Smith. Jl. Amer. Chem. Soc., 1922, **44**, 2255-2259.

The preparation and some physical properties of anhydrous magnesium perchlorate, the hexahydrate and the trihydrate are described. When the gas flow is not over 5 litres per hr. anhydrous magnesium perchlorate is as efficient a drying agent as phosphorus pentoxide. The trihydrate compares favourably with the anhydrous salt at 0° and at equal rates of gas flow, but at higher temperatures it is less efficient. The advantages of anhydrous magnesium perchlorate as a drying agent are pointed out.

—B. C. I. R. A.

Temperature Regulator. See Section 10.

(G)—BLEACHING.

Paper Pulp; Bleaching——. E. Sutermeister. Chem. Abstr. (from Paper Industry, 1922, **3**, 1640-1645), 1922, **16**, 3204.

Data are given to prove that the more bleach liquor fibres require the greater will be the weight lost due to bleaching. This applies to pulps made in the same mill at different times. The loss in weight decreases with rising temperature. When an excess of bleach is added to the pulp, and the excess is removed by washing at the end of a definite period, higher temperature causes more loss in weight because more bleach is used up. In permanganate bleaching the colouring matter is attacked very rapidly, the cellulose itself slowly. Bleaching increases the strength of sulphite cellulose fibre to a certain point, after which it decreases, but with soda cellulose fibre there is a decrease as bleaching proceeds. The injurious effect of oxycellulose is said to be much overrated. At the end of two years sheets containing oxycellulose were less yellow than those containing none. The incomplete removal of dissolved organic matter causes bleached fibre to be more yellow than if it were thoroughly washed.

—B. C. I. R. A.

Frankfort Bleaching Apparatus. F. H. Thies. Text. Rec., 1922, **40**, No.475, 95-96.

In this process the goods are first steeped in acid, then treated twice with sodium peroxide solution containing stabilisers, without actual boiling, in a concrete tank, and finally washed. A diagram of the plant is given. —B. C. I. R. A.

Bleaching. F. H. Thies. Text. Rec., 1922, **40**, No.475, 91-97.

The author compares and contrasts the two systems of bleaching—"boiling bleaching," which is the usual lime-soda or caustic soda scour followed by hypochlorite, and "combination bleaching," which involves the use of alkaline peroxides, and thus combines the two operations in one. Some data are given on the stretching factor, loss of weight, tenacity, colour, etc., of goods bleached by the various methods. The loss of weight is much greater in "boiling bleaching." The important statement is made that during the boil there is a great tendency for certain non-cellulose substances to resinify, and the effects of this are discussed at some length. The resinified material is difficult to bleach, and, although a good "white" may be obtained, the goods will become yellow if the resinous matter is not completely removed. Moreover, the resinified products consume an excessive amount of alkali. For these reasons, the author recommends a preliminary acid steep ("maceration") to loosen the non-celluloses, followed by rinsing. The goods are then boiled twice, with an intermediate rinsing in hot water. With regard to the danger of the formation of oxycellulose in the alkali boil, it is said that the important controlling factors are, first, temperature, then oxygen concentration, and finally hydroxyl-ion concentration, whilst the time factor is unimportant. In connection with "combination bleaching," the author states his theory of "Intermittent boiling" (Z. angew. Chem., 1921, **34**, 220) to account for the scouring which takes place, and also refers to "stabilising" agents which reduce the rate of evolution of oxygen from the peroxide, and "exciting" agents which promote this decomposition and are usefully employed in the case of dilute solutions. The former agents include magnesium salts, silicates, soaps and colloidal clays; the latter include tetralin and turpentine. —B. C. I. R. A.

Mohr-Ten Cate Bleaching Apparatus. F. H. Thies. Text. Rec., 1922, **40**, No.475, 95-96.

This process is a combination of hypochlorite and peroxide bleaching, and the plant, which is described and illustrated, is designed to allow both actions to be carried out consecutively, with the possibility of "intermittent boiling" at any time. The peroxide solution is actually activated, instead of retarded, as in the Frankfort process. —B. C. I. R. A.

Zinc Oxide and Lithopone as a Basis for Paint in Bleacheries and Dyehouses. See Section 10.

(H)—MERCERISING.

Mercerisation. E. O. Cole. Color Trade Jl., 1922, **11**, 195.

A mercerising machine which is specially constructed to effect even stretching of yarn in the hank form is described and illustrated. —L. M. S.

On Some Important but Overlooked Properties of Cotton, Mercerised by Means of Sodium Hydroxide or Sodium Chromite. J. Pokorny. Jl. Soc. Dyers and Colourists, 1922, **38**, 248-250.
When cotton is treated with sodium hydroxide it becomes slightly basic and will attract acid colours equally well, whether applied in an alkaline or acid bath or even if the mercerised cotton is first treated with hot dilute hydrochloric acid before dyeing. The strength of mercerised yarn, however, is reduced 30-50% by treatment with hot acid. The author believes that the art of mercerising for lustre has reached its summit, whereas there is considerable scope for investigation into the best conditions for imparting the maximum basic properties.
When cotton is treated with an alkaline chromite solution, prepared from chrome alum or green chromium acetate and sodium hydroxide, it is mercerised and mordanted as well, and acquires affinity for a large range of dyes. For example:—(1) It fixes all kinds of azo dyes, except basic ones, from aqueous solution; (2) it fixes all acid wool and silk colours from cold or warm, dilute solutions, slightly acidified with acetic acid; (3) it fixes other mordants, thus affording a new method for compound mordanting. If the mordanted cotton is allowed to dry, it becomes almost waterproof, and must be thoroughly boiled with water in order to wet it out for dyeing.
—B. C. I. R. A.

Mercerisation; History of——. Rev. Text., 1922, **20**, 1165-1167.
A historical account of the part played by Mercer (1850), Garnier and Depoully (1883), Lowe (1890), and Thomas and Prevost (1895) in the practical application of the behaviour of cotton when treated with strong caustic soda solutions. The term "similisage" has much to justify its use for processes whose object is to produce an enhanced lustre. In 1901 existing patents regarding the use of caustic soda for this purpose were annulled.
—L. I. R. A.

(I)—DYEING.

Dye-Works; Prevention and Removal of Steam-Clouds in——. H. Jaeger. Textilberichte, 1922, **3**, 386-388.
An installation for removing the clouds of vapour which occur in dye-works and the like, especially during cold weather, is described. Hot air drawn from the boiler-house is suitably distributed to the places where the steam-clouds arise. A diagram is given. —L. I. R. A.

Yarns; Hank Dyeing of——. H. Lagache. Rev. Textile, 1922, **20**, 1167-1171.
A continuation of the previous article (This *Jl.*, Abs., 1922, **13**, 205). A machine is described which is intended for dyeing a collection of threads a variety of colours along their lengths in order to permit of their use for forming the weft of plaid ribbons or similar articles. —L. I. R. A.

Dye Bath: Photometry. R. Auerbach. Kolloid Zeitsch., 1922, **31**, 37-38.
A method is described for comparing the colour tone of a dyed fibre with the tone of the dye bath. A Wolf's photometer and Ostwald's colour atlas are employed.
—B. C. I. R. A.

Heather Effects in Hosiery. L. C. Hayes. Color Trade Jl., 1922, **11**, 202.
The methods and dyes used for the production of heather effects on hosiery composed of all wool, silk and wool, cotton and wool, and artificial silk and wool are detailed. —L. M. S.

Wool Constitution: Dyeing of Amino Groups. W. W. Paddon. Jl. Soc. Chem. Ind. (from Jl. Phys. Chem., 1922, **26**, 384-389), 1922, **41**, 411A.
Experiments with wool deaminated by treatment with hydrochloric acid and sodium nitrite showed that the amino groups of wool take no part in the dyeing of this fibre by acid dyes such as Orange II. and Lake Scarlet R. —L. M. S.

Small Scale Dyeing or Bleaching. Dyer and Calico Printer, 1922, **48**, 180.
An apparatus for small scale dyeing or bleaching is described. All the steps of the process are carried out successively in a single machine. —B. C. I. R. A.

Dye: Fastness to Fumes. E. Ristenpart and P. Wieland. Textilberichte, 1922, **3**, 397.
The authors quote an instance of a glove fabric, sensitive to formaldehyde fumes, which had been dyed with four dyes. Each dye individually was fast to formaldehyde fumes, but when any two were employed together the combination was not fast. A suggested explanation of this phenomenon is based on the assumption that formaldehyde is a virtually unsaturated compound which can act as if it contained a free carbon and a free oxygen valency, and attacks dyestuff molecules containing a double bond. It is therefore possible that the coupling of two dyes facilitates such an attack. —B. C. I. R. A.

Zinc Oxide and Lithopone as a Basis for Paint in Bleacheries and Dyehouses. See Section 10.

The Spectral Transmissive Properties of Dyes. See Section 6.

Dyes; Testing Fastness of——. See Section 6.

Temperature Regulator. See Section 10.

On Some Important but Overlooked Properties of Cotton, Mercerised by Means of Sodium Hydroxide or Sodium Chromite. See Section 4H.

(K)—FINISHING.

Cotton Finishing. Text. Rec., 1922, **40**, No.475, 77.
A general article on dyeing and finishing, indicating where and why common practice is being amended and pointing out the direction in which improvements are desirable. —B. C. I. R. A.

Raising Machine. Text. Rec., 1922, **40**, No.475, 169.
A 36-roller raising machine, 80 inches wide, is described. —B. C. I. R. A.

Cloth; Fireproofing——. L'Ind. Text., 1922, **38**, 466-468.
In connection with fireproofing the decorations and hangings of public halls, concert rooms, etc., it has been ascertained that a mixture containing 6 parts of borax and 5 parts of boric acid in solution in water renders cloth of this type fireproof and does not alter it in any other way. The material may be soaked in the solution or the borax and boric acid can be added to the size used for finishing the cloth.
—B. C. I. R. A.

New Thread Effect and Finishing Process. Dyer and Calico Printer, 1922, **48**, 168.
A specially finished cloth, intended for wall covering, is produced by using slub yarn as weft. The woven goods are mercerised and bleached, the mercerising process causing the slubs to stand out in relief. The fabric is then padded with thickened dyestuff, dried, and coated in a back-starching machine. The first coat of colour is then put on by means of a printing machine with a pin roller. The fabric is calendered, preferably by means of a friction calender. —B. C. I. R. A.

(L)—WATERPROOFING.

Paper; Waterproofing——. Deuts. Faserstoffe, 1922, **4**, 103-104.
Paper can be waterproofed by impregnating it with ozokerite and subsequently allowing salts of the heavy metals to act on the impregnated material. The ozokerite is made into an emulsion with sodium or potassium hydroxide and diluted with water to the desired strength. Paper yarns or fabrics are passed through this bath at 50°C., thence, partially dried, to a solution of heavy metal salts (iron, copper, etc.).
—B. C. I. R. A.

Montan Wax as a Finishing Material for Paper Yarn, etc. Deuts. Faserstoffe (from Die chemisch-technische Industrie), 1922, **4**, 103.
Materials may be waterproofed by the use of an emulsion of montan wax with or without the additional use of salts of heavy metals. Information as to the preparation and application of the emulsion is given.
—L. I. R. A.

Linen Fabrics; The Manufacture of Waterproof——. J. Schmidt. Color Trade Jl., 1922, **11**, 34-36.
General instructions and formulæ are given for waterproofing by means of aluminium and calcium soaps and aluminium-ozokerite compound.
—L. I. R. A.

PATENTS.

Dyeing Apparatus. J. D. Henon, Philadelphia, Pa. U.S.P.1,433,276, 24/10/22; Appl., 3/9/21.
Comprises a vat with partition, means for circulating the dye, and a deflector or baffle, semi-oval in cross-section, to the inner faces of the walls of the vat and partition for deflecting the liquid out of the lines of least resistance. —A.

5.—LAUNDERING AND DRY-CLEANING.

Bleaching in Laundries. Amer. Dyestuff Reporter (from Starchroom Laundry Jl.), 1922, **11**, 325.
The relative merits of peroxide and chlorine bleaches for laundries are discussed. —L. M. S.

6.—ANALYSIS, TESTING, GRADING, AND DEFECTS.

The Spectral Transmissive Properties of Dyes. K. S. Gibson, H. J. McNicholas, W. E. Matthewson, E. P. T. Tyndall and M. K. Frehafer. Jl. Franklin Inst. (from U.S. Bur. Standards, Scientific Papers, No.440), 1922, **194**, 387.
The apparatus and methods used are described and the data already obtained are presented with tables and graphs.
—L. M. S.

Photomicrography of Paper Fibres. R. E. Loftin. Jl. Franklin Inst. (from U.S. Bureau Standards, Technologic Papers, No.217), 1922, **194**, 383.
The author's process is described.
—L. M. S.

Manganese; Estimation of—. St. Minovici and C. Kollo. Chim. et Ind., 1922, **8**, 499-500.
Details are given of a new method for estimating manganese, based on its precipitation as iodate. The method is rapid and accurate, and has the advantage of being applicable when only small quantities of manganese are present.
—B. C. I. R. A.

Magnesium; Estimation of——. F. S. Hammett and E. T. Adams. Jl. Biol. Chem., 1922, **52**, 211-215; see also A. P. Briggs, *ibid*, 349-355.
Small amounts of magnesium can be estimated by precipitating the magnesium as ammonium magnesium phosphate according to the method of Kramer and Tisdall, and estimating colorimetrically by the phosphorus method of Bell and Doisy.
—B. C. I. R. A.

Mould Spore. J. Weinzirl. Rev. appl. Mycol. (from Papers on Bacteriology, etc., Univ. of Wisconsin Studies in Science, 1921, **2**, 55-59), 1922, **1**, 337.

Various Mucor, Aspergillus, Oidium, and Penicillium spores were found to withstand to a very high degree five days' exposure to the intense rays of a summer sun, thus contrasting greatly with bacterial spores. The pigment in the spores may afford some protection, but the Oidium spores, although colourless, were equally resistant. It may be that mould spores have less water attached to the protoplasm than other spores (they are relatively light), and are thus able to resist adverse agents more successfully. —B. C. I. R. A.

Sterols; Test for——. L. Kahlenberg. Jl. Biol. Chem., 1922, **52**, 217-225.

Arsenic trichloride gives coloured solutions with sterols as follows:—Cholesterol gives a pink solution which gradually turns to a bright cherry-red on standing, more rapidly on heating; isocholesterol gives a cobalt blue solution which changes to violet, then to purple, dark red, and dark green on standing, more rapidly on heating; phytosterol gives colourless solutions. The colour of these solutions is discharged by adding solvents such as benzene, toluene, or chloroform. —B. C. I. R. A.

Asbestos-Cotton Mixture; Analysis of——. P. Heermann and H. Sommer. Textilberichte, 1922, **3**, 340, 361, 382.

A series of articles dealing with the estimation of cotton in mixtures of asbestos and cotton. Seven different methods are discussed, but that based on the solubility of cellulose in cuprammonium is recommended. In order to ascertain the best experimental conditions, the behaviour of different kinds of cotton towards cuprammonium under varied conditions was investigated. Rapid and complete solution is effected by (1) use of a freshly prepared, cold cuprammonium solution with the highest possible copper content, (2) cutting up the fibre into the smallest possible pieces, (3) previous removal of the cotton waxes, preferably with ether and alcohol, (4) repeated shaking. The cellulose is recovered by acidifying the solution with dilute sulphuric acid. Organic acids may also be used.

—B. C. I. R. A.

Cellulose. J. Strachan. Chem. Abst. (from World's Paper Trade Review, 1922, **78**, 374), 1922, **16**, 3392.

Pure cellulose appears to have a refractive index of approximately 1·555 for daylight, so that its index of visibility is low in Canada balsam. For temporary mounts, unstained fibres in water or iodine-stained fibres in sodium chloride solution are most convenient. For permanent mounts, pure bleached cellulose is best stained with a basic aniline dye and mounted in xylene-balsam. Magenta, on account of its high refractive index, is a suitable dye.

—B. C. I. R. A.

Carbon; Estimation of——. D. Florentin. Bull. Soc. Chim., 1922, **31**, 1068-1072.

The possibility of establishing a rapid and practical method for the estimation of carbon in organic compounds, coal, etc., by oxidising the compound with a mixture of sulphuric and chromic acids and weighing the evolved carbon dioxide in a potash bulb, has been investigated. It was ascertained that the results were always too low compared with those obtained by the method of Dumas. It was then established that a considerable quantity of carbon monoxide was formed, and for any degree of accuracy to be attained by such a method it is essential that the evolved gases should be passed over heated copper oxide before passing to the potash bulb.

—B. C. I. R. A.

Cobalt Carbonate; Application of——. V. Lenher. Jl. Amer. Chem. Soc., 1922, **44**, 1664-1665.

The best agent for detecting the presence of moisture in such a liquid as selenium oxychloride was found to be cobalt carbonate which had been dried at 200° in a current of dry carbon dioxide. Minute traces of water caused the carbonate to become instantly blue. —B. C. I. R. A.

Cellulose Formate; Properties of——. B. Rassow. Chem. Zeit., 1922, **46**, 886-887.

The formic acid content of cellulose formates prepared by treating cellulose with a mixture of phosphorus oxychloride, sodium formate and formic acid may be as much as 30%. The esters are derived from a considerably degraded cellulose molecule. If the sodium formate is omitted from the reaction mixture the cellulose is still further degraded and the product has a still higher formic acid content. Cellulose formates are not built up according to simple molecular ratios and never reach the composition of a triformate. The values lie chiefly between those of a mono- and a di-formate. All cellulose formates dissolve in a concentrated solution of zinc chloride and strong formic acid. The products with high formic acid content dissolve more or less readily in phenol, pyridine, etc. Phenol can be used to separate a mixture into fractions having respectively high and low formic acid contents. Cellulose formates are very unstable. —B. C. I. R. A.

Phosphorus; Estimation of——. A. P. Briggs. Jl. Biol. Chem., 1922, **53**, 13-16.

The Bell-Doisy colorimetric method is subject to the objection that the alkaline blue solution used for comparison fades rather rapidly. The stable green first produced in acid solution was not used by Bell and Doisy because a turbidity is occasionally produced when the acid molybdate solution is added. If, however, a little sodium sulphite is added to an acid solution containing phosphate and molybdate, the subsequent addition of hydroquinone gives a clear blue, non-fading colour for comparison.

—B. C. I. R. A.

Formaldehyde; Detection of——. E. Ristenpart and P. Wieland. Textilberichte, 1922, **3**, 397.

The authors criticise adversely the method proposed by Heermann (This *Jl.*, Abs., 1922, **13**, 109), stating that the magenta-sulphurous acid reagent is very unstable and that the red colour observed when the material to be tested is brought into direct contact with the reagent may be due to causes other than the presence of formaldehyde. The test sample should be distilled in steam and the distillate tested for formaldehyde. —B. C. I. R. A.

Enzymes. S. A. Waksman. Abstr. Bact., 1922, **6**, 265-299.

A comprehensive review of the occurrence, classification, and activity of the enzymes of micro-organisms, with nearly 1,000 references to the literature.

—B. C. I. R. A.

Cellulose; Reactions of——with Sodium Chloride and other Neutral Salt Solutions. H. Masters. Trans. Chem. Soc., 1922, **121**, 2026-2034.

When thoroughly washed cotton is extracted with a neutral solution of sodium chloride, the extract has an acid reaction. If the cotton is subsequently extracted with water, the water has an alkaline reaction and the amount of alkali liberated in the second case is approximately equivalent to the amount of acid liberated by the sodium chloride treatment. On passing sodium chloride through cotton which had previously been extracted with sodium chloride and with water, an acid extract was again obtained. Various samples of cotton were employed and various modifications were made in its preliminary treatment, but in all cases the same phenomenon was observed. Ammonium chloride and sodium sulphate gave results similar to the above. Barium chloride and calcium chloride extract considerably less acid than sodium chloride. With cadmium iodide the washings did not become alkaline. Acid was also liberated when sodium formate (slightly alkaline to litmus) was passed through washed cotton.

—B. C. I. R. A.

Stannic Oxide Hydrates; Properties of——. H. B. Weiser. Jl. Phys. Chem., 1922, **26**, 654-686.

A long account of careful experiments on the stannic oxide hydrates dealing with the peptisation and gel formation of stannic oxide and the coagulation of stannic oxide sols. In connection with mordanting, it is stated that hydrous stannic oxides prepared at different temperatures or "aged" for varying lengths of time are chemical individuals which differ from each other in the size of the particles and the structure of the mass, and hence in their adsorptive power and mordanting action their ease of peptisation and their solubility. —B. C. I. R. A.

Air; Drying——. H. Isobe. Chem. Abstr. (from Eng. Chem. Jl. Japan, 1921, **1**, 99-102), 1922, **16**, 3352.

The author has investigated the possibility of drying large quantities of air by adsorption in various charcoals and clays.

—B. C. I. R. A.

Starch Iodide: Constitution. H. v. Euler, S. Bergman and S. Landergren. Kolloid-Zeits., 1922, **31**, 81-89 and 89-90.

Two papers giving an account of the further investigation of the nature of starch iodide (This *Jl.*, Abs., 1922, **13**, 189). The authors have employed soluble starch and have studied (1) the partition of iodine between benzene and water, potassium iodide solution, starch solution and starch solutions containing different proportions of potassium iodide, and (2) the influence of the concentration of the starch on the amount of iodide taken up. It is shown that aqueous solutions of soluble starch dissolve more iodine than pure water and that the solubility of iodine in starch solutions containing potassium iodide is greater than the sum of the solubilities in the corresponding potassium iodide and starch solutions. That is, starch takes up more iodine in the presence of potassium iodide. This result has been confirmed colorimetrically by measuring the selective adsorption of blue starch-iodide solutions. The authors conclude that starch takes up iodide both in the molecular state and as potassium tri-iodide. In the second investigation it is shown that in solutions of varying starch content and constant potassium iodide content the amount of iodine taken up from toluene solutions of iodine does not increase with increasing starch concentration.

—B. C. I. R. A.

Solid Particles: Wetting. R. H. Jarvis and D. W. Leake. Chem. Abstr. (from Eng. Mining J. Press, 1922, **114**, 17-18), 1922, **16**, 3244.

Simple experiments are described to show that particles on a liquid surface which are wetted attract each other, but are repelled by dry particles. Particles which can be wetted by water are attracted by a positively charged hard rubber rod, while particles not wetted are repelled.

—B. C. I. R. A.

Soil Colloid; Estimation of——. W. O. Robinson. Jl. Phys. Chem., 1922, **26**, 647-653.

Samples of the colloidal matter extracted from 34 soils which differed widely in texture, origin, mode of formation and chemical composition showed a relatively constant absorption of water. The extreme absorptions were 0·240 grams and 0·348 grams of water per gram of colloid, and the mean value was 0·298. It is suggested that the colloidal matter in a soil might be fairly closely estimated by determining under certain conditions the water absorption of the soil and dividing the result by the average factor 0·298. —B. C. I. R. A.

Hydrogen-Ion; Determination of——. G. E. Cullen and A. B. Hastings. Jl. Biol. Chem., 1922, **52**, 517-520.

The authors show that the colorimetric and electrometric methods for determining the hydrogen ion concentration of solutions containing carbon dioxide agree when carried out with rigorous precautions to prevent loss of carbon dioxide. —B. C. I. R. A.

Photochemical Catalyst. E. C. C. Baly. Rec. Trav. Chim., 1922, **41**, 516-529.

A long report (in English) on photochemical catalysis, in which the author develops his well-known theories on radiation. —B. C. I. R. A.

Fuller's Earth: Catalytic Action. E. K. Rideal and W. Thomas. Trans. Chem. Soc., 1922, **121**, 2119-2123.

The three typical varieties of fuller's earth, Florida, Surrey and Somerset, are widely different in specific surface, adsorption and catalytic activities. The adsorption of methylene blue from aqueous solutions is approximately proportional to the specific surfaces of the earths (neglecting porosity, if any). The ratios of the specific surfaces are:—Surrey: Somerset: Florida = 2·35: 2·13:1, and the ratios of the equilibrium concentrations for equipartition of the dye between solvent and adsorbent are 2·54:2·18:1. The catalytic activities in the decomposition of hydrogen peroxide are not dependent on the adsorptive power, and it appears that the iron content of the fuller's earth may be the governing factor in catalysis. —B. C. I. R. A.

Gelatin Gel: Thermal Expansion. A. Taffel. Trans. Chem. Soc., 1922, **121**, 1971-1984.

An accurate dilatometer is described and a method of filling it with gelatin solution free from air-bubbles. It is shown that gelatin gels expand regularly with increasing temperature. The coefficients of expansion and specific volumes for any one temperature are a linear function of the concentration of the gel. Hydrogen-ion does not affect the coefficient of expansion. The contraction resulting on the swelling of gelatin in water is a linear function of the concentration of the gel expressed as grams of gelatin per gram of water at any one temperature, and of the temperature for any one gel. An explanation has been offered of the curve of double flexure obtained by Sheppard and Sweet for the relationship between concentration and setting point of gelatin gels (This *Jl.*, 1921, **12**, 288). The temperatures of maximum density of gelatin gels up to 12% concentration have been determined. Gelatin lowers the temperature of maximum density of water by an amount directly proportional to its concentration, expressed as grams of gelatin per 100 grams of water. —B. C. I. R. A.

Dye: Dispersivity. R. Auerbach. Kolloid-Zeits., 1922, **31**, 37-40.

By means of a number of dyeings of wool and cotton with basic acid and substantive dyes it was shown that, in most cases, a displacement of the shade of the fibre with respect to its dye-bath takes place in a bathochromic direction, in a few cases the fibre and dye-bath exhibited the same tone, and in two cases the displacement was hypsochromic. These results are explained by the diminished degree of dispersion of the dyestuff in the dyeing process combined with the polychromic properties of the dyes. —B. C. I. R. A.

Emulsions; Preparation of——. G. L. Clark and W. A. Mann. Jl. Biol. Chem., 1922, **52**, 157-182.

The authors have endeavoured to determine the essential attributes of an emulsifying agent or colloid protector. Measurements were made of the surface tension, interfacial tension, and viscosity of solutions of sugars, dextrin, starch, gum arabic and egg albumin, at all concentrations, both alone and in the presence of each of five electrolytes, viz., hydrochloric acid, sodium hydroxide, iodide, sulphate and bicarbonate. It is shown that no general rule can be stated as to the effect which produces the best emulsions for any one substance, nor can any one generalisation be made as to the effect which produces best emulsions for all substances under all conditions. Viscosity and film formation by adsorption at liquid interfaces seem to be of primary importance, especially the latter, since it was with egg albumin, where a film formation is quite marked, that the best emulsions were obtained. —B. C. I. R. A.

Colloidal Solution: Dielectric Constant. J. Errera. Kolloid-Zeits., 1922, **31**, 59-64.

A method for measuring the dielectric constant of colloidal solutions is described. An interesting case is that of vanadium pentoxide, of which the dielectric constant, in a 1·4% solution, is 400 compared with 81 for water. This high value was confirmed in different ways. The rise of the dielectric constant is a consequence of the ageing of the sol and depends on the temperature, current density and the potential amplitude. The observed effect is unquestionably connected with the double refraction of this sol. —B. C. I. R. A.

Colloid Mill. A. Forster and J. Reilly. Jl. Soc. Chem. Ind., 1922, **41**, 435-438R.

A detailed account of the construction and control of the Plauson colloid mill. The industrial uses claimed for the mill are discussed. These include (1) the preparation of plastic masses for insulators, buttons, bricks, etc.; (2) the preparation of colloidal solutions for disinfectants, fertilisers, lubricants, paints, etc.; (3) the division of materials for chemical action; (4) the separation of mixtures by fractional disintegration. —B. C. I. R. A.

Soap Solution. M. H. Norris. Trans. Chem. Soc., 1922, **121**, 2161-2168.

Hexadecanesulphonic acid is a hydrogen soap having the typical behaviour of a colloidal electrolyte in its conductivity, osmotic activity and high temperature coefficient of solubility. Its place is among the highest soaps, between sodium stearate and behenate. The behaviour of α- and sodium β-naphthalone sulphonates and of sodium anthraquinonesulphonate lends support to the assumption that the length of the molecule is an important factor in producing a colloidal electrolyte. Thus the α-form is less colloidal than the β-form, and the ring compounds are far less colloidal than the open chain compounds with the same number of carbon atoms.
—B. C. I. R. A.

Elutriator; Application of——. T. M. Lowry and others. Trans. Faraday Soc., 1922, **18**, 22-77.

A general discussion on the grading of powders by elutriation. —B. C. I. R. A.

Ultra-Filter. J. W. McBain and W. J. Jenkins. Trans. Chem. Soc., 1922, **121**, 2326.

A working scale drawing of the ultra-filter employed by the authors in their investigation of soap solutions is given. The ultra-filter was designed for use with much higher pressures than any hitherto employed. It may be surrounded with a thermostat and the filtrate collected out of contact with the atmosphere or carbon dioxide, and it lends itself to testing for the absence of leakage and determination of the size of pores in the membrane without disturbing the latter, merely by removing the funnel underneath.
—B. C. I. R. A.

Buffer Substances. D. D. van Slyke. Jl. Biol. Chem., 1922, **52**, 525-570.

A paper " On the Measurement of Buffer Values and on the Relationships of Buffer Value to the Dissociation Constant of the Buffer and the Concentration and Reaction of the Buffer Solution." The author deals with the subject as follows:—(1) The nature and mode of action of buffers. (2) Unit for measurement of buffer values. (3) The buffer value of water with only strong acid or alkali. (4) The buffer value of a solution containing a weak univalent acid and its salt; (*a*) fundamental mass-law equations; (*b*) differentiation of Henderson's equation in order to calculate the buffer values of weak acids; (*c*) second derivative of Henderson's equation, point of maximum buffer value; (*d*) general equation indicating the dissociation of a weak acid at all reactions within the limits of validity of the mass law. (5) Polyvalent acid buffers and mixtures of univalent acid buffers. (6) Basic buffers. (7) Amphoteric buffers. (8) Universal buffer mixtures. (9) The buffer value of blood. (10) Determination of the buffer values of a solution by titration. —B. C. I. R. A.

Aluminium; Estimation of——. F. L. Hahn and G. Leimbach. Ber., 1922, **55**, 3162.

The precipitation of aluminium by sodium thiosulphate, following the procedure hitherto described, is imperfect. If the mixture is brought to the boil, however, and a weak base, preferably phenylhydrazine, is then added, to remove the residual trace of aluminium in solution, a satisfactory precipitation is effected, even in the presence of iron. —B. C. I. R. A.

Yarn Strength. E. D. Walen. Text. World, 1922, **62**, 2021-2023.

The relation of cotton strength to yarn strength is analysed. It is shown that (1) the strength of cotton increases with the length of the fibre, (2) yarn strength is directly dependent on cotton strength, (3) stronger cottons possess the greater " spirality," *i.e.*, convolution number; the question is raised whether yarn strength is due to spirality or cotton strength, (4) using the same cotton, in one mill the strength increased rapidly through the pickers and showed a slight increase through the machine to the roving; in a second mill the strength showed a steady increase through the drawing and an abrupt drop; in a third mill, the strength declined in the pickers and then remained fairly constant throughout. The author states that as a general thing a rise in strength in the operations beyond carding is accompanied by an uneven yarn due to the broken fibres remaining in the yarn, and advances the theory that treatment in the pickers severe enough to cause fibre breaking may be beneficial. It would appear that a picking and carding operation which did not damage cotton at all would produce a weaker yarn than one which did. —B. C. I. R. A.

Starch; Properties of——. M. Samec and A. Mayer. Koll. Beihefte, 1922, **16**, 89-98.

A continuation of earlier work (This *Jl.*, Abs., 1922, **13**, 111) on the properties of starch. By esterification of the erythroamyloses obtained from starch granules, with phosphoric acid, a product completely corresponding with amylopectin is obtained and esterification of the amyloamyloses with phosphoric acid converts them into a gelatinous substance analogous to amylopectin. The iodine colour of the phosphoric acid product is the same as the iodine colour of the initial substances provided that no fundamental change in the material has taken place during esterification. The colouration with iodine is, therefore, independent, within wide limits, of the degree of hydration and the degree of association. The contradictory statements concerning the iodine colour of amylopectin are explained. A comparison of the individual phosphoric acid derivatives of starch with one another furnishes a new starting point from which to gain an understanding of " jelly formation."
—B. C. I. R. A.

Sodium Thiosulphate Solution: Preservation of——. F. L. Hahn and H. Windisch. Ber., 1922, **55**, 3163-3165.

The addition of a trace of alkali to sodium thiosulphate solution prevents any change in its composition, the best results being obtained when the solution is N/50000 with respect to sodium carbonate. It appears, therefore, that such changes can be traced to the slightly acid reaction of the distilled water. They do not depend on the formation of sodium sulphite or sulphide.

—B. C. I. R. A.

Oil Emulsion; Preparation of——. S. P. Kramer. Kolloid Zeits., 1922, **31**, 149-150.

A fine, stable emulsion is formed immediately when a certain quantity of plant or animal oil is added to a 0·2% solution of sodium silicate. If this emulsion is examined under the ultra-microscope it is seen to be so fine that many of the oil drops show the Brownion movement. The explanation of the formation of the emulsion is that the free fatty acid of the oil combines with the sodium to form a sodium soap, thus liberating free colloidal silicic acid which acts as a protective colloid. The properties of the emulsion are discussed. —B. C. I. R. A.

Coloured Hydrosols: Nephelometry. H. Bechhold and F. Hebler. Kolloid Zeits., 1922, **31**, 7-12.

In the nephelometric investigation of white turbidities it has been repeatedly shown that a strict proportionality exists between the concentration of the substance causing the turbidity and the amount of diffracted light, provided that no change occurs in the original substance. It is now shown that in the case of coloured sols and turbidities very marked deviations from this proportionality occur. Concentrated coloured sols such as colloidal indigotin and silver behave in comparison with dilute solutions as though they were less concentrated. This is shown to be due to the absorption of light by the coloured particles forming the turbidity. This action in the case of white particles is not great, but in that of coloured particles is very strong. The disproportionality in the absorption is caused particularly by those wave-lengths which are absorbed by the turbid medium to a larger or smaller extent. This selective absorption must therefore be removed by suitable light filters, the most efficient of which are isochromatic filters, that is thin layers composed of the substance under investigation. These filters may be employed as solutions or as dry gelatin films between the source of light and the nephelometer. In this way it is possible to investigate nephelometrically coloured turbidities and coloured hydrosols in exactly the same way as colourless turbidities, and in these circumstances they show exactly the same proportionality between concentration and amount of diffracted light as white turbidities. —B. C. I. R. A.

Organic Carbon and Hydrogen; Estimation of——. L. J. Simon and A. J. A. Guillaumin. Compt. rend., 1922, **175**, 525-527.

The methods previously described for the estimation of carbon in organic compounds by oxidation with sulphuric acid and chromic anhydride or silver chromate, and subsequent measurement of the carbon dioxide formed, have been modified to include the estimation of the hydrogen present in the compound by employing a weighed excess of oxidising agent and estimating the excess by one of the standard methods. Potassium dichromate is substituted for chromic anhydride, and the excess is estimated by means of ferrous sulphate and permanganate. The limits of applicability of the method are discussed.

—B. C. I. R. A.

Starch: Constitution. A. Pictet and R. Jahn. Helv. Chim. Acta, 1922, **5**, 640-644.

The properties of a new depolymerisation product of starch are described. The substance, which is provisionally called "trihexosan," was prepared by heating potato starch in glycerol at 200—210° until no colour was produced with iodine. The glycerol was then distilled off in a vacuum at the same temperature, leaving a pale yellow, vitreous, transparent mass, which was dissolved in water. After concentrating the solution to a syrupy consistency and removing the last traces of glycerin by means of alcohol, a white amorphous powder was obtained which was purified by solution in water and re-precipitation with alcohol. The substance has all the characters of a homogeneous body, and its weight is 90% of that of the original starch. A comparison of the properties of trihexosan with those of the triamyloses shows it to be a distinct substance.

—B. C. I. R. A.

Plant Chlorine; Distribution and Estimation of——. J. Jung. Chem. Abstr. (from Sitzb. Akad. Wiss., Wien, 1920, **129**, 297-340), 1922, **16**, 3110.

Several hundred microchemical examinations of plants for chlorine are reported. Two reagents were developed for detecting chlorine, (1) thallium acetate, glycerol and water, (2) silver nitrate and ammonia. Chlorine is found in plants only as chloride and only a few plants lack chlorine entirely, notably the conifers. Some families are characterised by high and some by low chlorine content. The chlorine usually increases in amount from the roots to the leaves; it is most abundant in succulent, parenchymatous tissues, apparently being dissolved in the cell sap. It is usually scarce in the epidermis, bundles, hairs, flower parts, pollen, woody tissue, and chlorophyllous mesophyl, and abundant in fleshy roots and rhizomes. Plants that grow in rich, moist soil and in the sea are richer in chlorine than those growing in sandy soils, heaths and fresh water. —B. C. I. R. A.

Starch; Testing——. J. F. and Una Liverseege. Analyst, 1922, **47,** 430.

The "lycopodium equivalent," or the number of starch grains contained in a weight of the sample equal to the weight of 100 lycopodium spores, is a convenient unit for the comparison of starches and the detection of adulteration by Wallis's method (Analyst, 1916, **41,** 357). The weight of 100 spores may be obtained by floating a weighed amount of lycopodium in olive oil and counting in a Zappert chamber, but the value is not required in starch testing. For the latter purpose, definite weights of lycopodium and the sample are mixed in olive oil, and the spores and granules are separately counted.
—B. C. I. R. A.

Colloid: Precipitation. H. V. Tartar and Z. J. Gailey. Jl. Amer. Chem. Soc., 1922, **44,** 2212-2218.

A study has been made of the effect of hydrogen-ion concentration on the precipitation of mastic and gamboge sols by acids and salt solutions. Acids cause precipitation at the same hydrogen-ion concentration regardless of the concentration of the colloid. The negative ion of the acid is without effect. Various potassium and ammonium salts precipitate the sols at the same concentration provided the hydrogen-ion concentration is kept approximately constant. The precipitating values of the salts vary directly as the concentration of the colloid at the same hydrogen-ion concentration. The stabilizing or peptizing effect of the ion bearing a charge similar to that of the colloidal particle has been shown to be very limited if it exists at all.
—B. C. I. R. A.

Colloid; Preparation of——. F. Sekera. Kolloid Zeits., 1922, **31,** 148-149.

A new process for the preparation of colloids is described which does not involve the initial formation of a colloidal solution. The substance to be brought into a colloidal state is dissolved in an organic solvent and the solution is "atomised" by means of suitable fine nozzles. An aero-sol of the solution is obtained, and to convert this into the aerosol of the dissolved substance it is brought into a hot chamber where the organic solvent vapourises and can be distilled off. The particles of substance dissolved in the individual emulsoid particles of the aerosol form the suspensoid particles. These remain floating in the hot chamber as a mist or are slowly precipitated on its walls. The coagulation of the aerosol to a reversible gel takes place slowly automatically, or can be brought about by centrifuging or by means of an electric spark. —B. C. I. R. A.

Scientific Instruments; The Mechanical Design of——. A. F. C. Pollard. Jl. Roy. Soc. Arts, 1922, **70,** 769, 783, 797.

An account of three lectures delivered before the Royal Society of Arts on the above-named subject. —B. C. I. R. A.

Adsorption. G. Stadnikoff. Kolloid. Zeits., 1922, **31,** 19-32.

The author differentiates four types of adsorption: (1) Solution adsorption, which is represented by Henry's law, (2) chemical adsorption, (3) combined adsorption, (4) exchange adsorption. The author is of the opinion that electrical adsorption can only be definitely proved in the case of an adsorbent of definite composition possessing either marked acid or basic properties, adsorbing either base or acid from solution. With the object of ascertaining whether a chemical explanation for adsorption is possible, the adsorption of sulphuric, hydrochloric, nitric and acetic acids and mixtures of two of these acids and also of iodine, by aniline-black has been investigated. The experimental results of other workers have been re-calculated from the point of view of chemical adsorption.
—B. C. I. R. A.

Thickness Gauge. O. F. Söhne. Z. Instrumentenkunde, 1922, **42,** 284.

The thickness gauge consists of a stand to which is fixed a small telescope adjusted for auto-collimation, and attached to its lower end to a movable lever which carries a mirror so arranged that every change in its position causes a displacement of the scale, visible through the ocular, with respect to a fixed zero. The extent of this displacement is a measure of the distance through which a point carried by the lever has moved, and hence is a measure of the thickness of the object under investigation.
—B. C. I. R. A.

Tensile Strength: Rock Salt Bar. M. Polanyi. Z. Physik, 1921, **7,** 323-327, and Sci. Abstr., 1922, **25A,** 389.

A theoretical paper on the nature of rupture by tensile stresses, based on observations made on rods of rock salt. The author suggests that the stressed rod of rock salt first stretches in accordance with the laws of mechanics, but that at a certain stress and elongation a quantum jump takes place leading to rupture.
—B. C. I. R. A.

Humidity Equilibria: Textile Fibres and Fabrics. R. E. Wilson and T. Fuwa. Jl. Ind. Eng. Chem., 1922, **14,** 913-918.

Data on the humidity equilibria of various common substances are collected for reference. The various types of humidity equilibrium curves are discussed. Curves are also given for various substances arranged in groups of related materials as follows:—Natural textile fibres (including absorbent cotton, cotton cloth, linen, jute, wool, raw silk, sisal hemp, and manila hemp), artificial textile fibres (including viscose, nitrocellulose and cellulose acetate silks), pulp and paper fibres, foodstuffs, other organic colloids, absorbents, various forms of carbon, and finely divided inorganic solids. If the relative humidity is kept constant there is surprisingly little change in the equilibrium moisture content of most substances over the ordinary range of indoor temperatures. —B. C. I. R. A.

Single-Thread Tester. Text. Rec., 1922, **40**, No.475, 203.

The single-thread tester illustrated makes and records on a paper strip 160 consecutive tests from each cop. The cycle of operations consists of (1) inward run of carriage presenting yarn to the nips at the front of the machine; (2) outward run of carriage, allowing a definite length of yarn to be delivered, and the breaking of this yarn in tension, with springs of special temper and guaranteed accuracy; (3) recording the strength on the diagram paper during the inward run of the carriage; (4) clearing the tested yarn away from the nips. —B. C. I. R. A.

Nephelometer Effects in Colloidal Systems of Various Dispersions. H. Bechhold and F. Hebler. Kolloid-Zeits., 1922, **31**, 70-74.

Working with suspensions of barium sulphate of accurately determined particle size, the authors find that as the dispersion of the suspensoid increases the turbidity passes through a maximum. At higher dispersions Rayleigh's law is applicable and the nephelometer may be used. —L. I. R. A.

Diffusion and Interaction. C. G. Schoneboom. Proc. Roy. Soc., 1922, **A.101**, No.A.713, 531-539.

Describes the interpenetration of superimposed solutions, which, under certain conditions, takes place at a far greater rate than ordinary diffusion. This can be detected in very varied solutions in water and organic liquids. The author concludes, therefore, that any explanation involving a hydration process is inadmissible and that the phenomena observed are due to certain relations between the surface tensions of the two solutions. —L. I. R. A.

Analysis of Dyestuffs; New Colorimetric Method of——. P. Dosne. Bull. Soc. Ind. Mulhouse, 1922, **88**, 73-77.

Each coloured solution has a definite and critical concentration at which the characteristic absorption spectrum is sharp and complete. For lower concentrations some of the lines are not visible, whilst for higher concentrations the bands broaden and blend into each other. The thickness of the layer in centimeters and by concentration (in cgrs. per litre) is called the specific index of coloration. —L. I. R. A.

Stannic Ion; Estimation of——. W. D. Treadwell. Helv. Chim. Acta, 1922, **5**, 817.

Stannic chloride is rapidly and completely reduced to stannous chloride by allowing the hot, strongly acid solution to flow slowly down a short column of finely divided lead. The reducing agent is prepared by dipping a zinc rod in a slightly acid, concentrated solution of lead acetate, washing the deposit with alcohol and ether, and drying it in a vacuum, when the lead may be crushed to a powder. —B. C. I. R. A.

Cotton Hair; Testing——. E. D. Walen. Text. World, 1922, **62**, 2017-2021.

Details are given of a group method of testing the strength of fibres in which a certain weight of fibres of a known length is employed so that the result can be expressed in terms of yarn number or hanks. An ordinary pull of cotton is straightened and the short fibres brushed out. The bundles are cut to a length of ⅞in., allowed to condition in a constant atmosphere and weighed in groups of five or ten. The ends of the bundles are cemented with collodion to a piece of paper. The strip of paper is cut parallel with the test specimens, and the whole is clamped in the jaws of the testing machine. The paper is now cut perpendicular to the specimens. By dividing the total strength by the sum of the weights, the strength of a group of fibres of known length and weighing 1 gram is obtained which is readily corrected to a yarn number or equivalent figure. —B. C. I. R. A.

Textile Fibres; Testing the Brittleness of—. P. Krais. Text. Forschung, 1922, **4**, 96-99.

An instrument is described which applies a percussion test transversely to fibres, yarns, or other textile products. The material to be examined is held in a clamp and passes over a supporting plate and then a pulley carrying a tensioning weight at its free end. A hammer of adjustable weight is lifted and dropped by suitable mechanism on the portion of the specimen which rests on the plate. The number of blows necessary to fracture the fibre or yarn is read from a revolution counter. The authors find great irregularity in the resistance to percussion of most of the materials they have examined. For instance, out of 22 different pieces of a 10 lea cotton yarn one broke after 13 blows and the most resistant only after 484 blows. —L. I. R. A.

Artificial Silk; The Cylindricity of——. A. Herzog. Text. Forschung, 1922, **4**, 99-100.

The author emphasises the importance of the connection between the form of cross-section of fibres and their physical properties, such as fineness, flexibility, transparency, gloss, and the apparent specific gravity of the yarns made from them. As a measure of the roundness of, in the present instance, artificial silk fibres, he proposes the ratio between the actual area of the cross-section and the area of the circle which will just enclose the fibre cross-section. —L. I. R. A.

Fabric Testing; Rubbing Apparatus for—. E. Muller. Text. Forschung, 1922, **4**, 95-96.

This apparatus comprises a plane rubbing surface carrying an adjustable load and reciprocated over the fabric to be tested by a motor driven disc and connecting rod. The test piece is held between two clamps and rests on a plane supporting surface. Any desired tension may be applied to the fabric while it is being rubbed.—L. I. R. A.

Cellulose; Bacterial Decomposition of——. N. L. Kosin. Chem. Zentr. (from Nach. d. Phys.-Chem. Lomonossow-Ges. Moskau, 1921, **2**, 57-98), 1922, iii, 874.

The author has ascertained that mildews, especially *Cladosporium*, decompose cellulose rapidly in the presence of air and mineral nutrient salts first yielding hexoses and finally carbon dioxide. About 25% of the cellulose was destroyed in 256 days. Saccharification is brought about by an enzyme which the author has isolated. A similar decomposition, in which sugars are formed, takes place in nature during the summer months. —B. C. I. R. A.

Dyes; Testing Fastness of——. B. Setlik. Chim. et Ind., 1922, **8**, 541-543.

A number of methods of testing the fastness of dyes on wool, cotton, or silk, under different conditions, are described.

—B. C. I. R. A.

Bacteria: Filtration. W. Frei and H. Erismann. Chem. Zentr. (from Zentr. f. Bakter. u. Parasitenk., 1922, **88**, 306-336), 1922, iv, 826-827.

The authors discuss the question of the function of sand filters in bacteria filtration on the basis of certain adsorption phenomena which they record. The effect of electrolytes on the filtering power of sand is not very pronounced, but the cathion effect appears to follow the order: $\mathrm{Mg} > \mathrm{Ca} > \mathrm{Na}$, $\mathrm{K} > \mathrm{Li}$. This effect is more striking in the case of paper filters and the cathion series is the same, with the exception that lithium causes such swelling of the cellulose that the passage of bacteria becomes slowest. —B. C. I. R. A.

Alkali Chlorates and Perchlorates; Estimation of——. W. D. Treadwell. Helv. Chim. Acta, 1922, **5**, 806-810.

Chlorates are quantitatively reduced to chlorides when their solutions, acidified with sulphuric acid, are allowed to trickle down a short column of electrolytic cadmium powder. Perchlorates are not reduced under these conditions, but are converted into chlorides by boiling with finely divided cadmium and a little titanic sulphate, in sulphuric acid solution, under reflux. Chlorates and perchlorates may therefore be estimated, singly or when both present, by means of these reductions.

—B. C. I. R. A.

Indigo; Estimation of——. W. D. Treadwell. Helv. Chim. Acta, 1922, **5**, 740-742.

The sample is dissolved in hot sulphuric acid (monohydrate) cooled, and diluted with water until it is about 0·05 to 0·1*N* with respect to indigo and 0·2 to 0·5*N* with respect to free acid. A measured portion of the solution is then allowed to trickle down a short tube over electrolytic cadmium powder, in an atmosphere of carbon dioxide. The reduced solution is re-oxidised by means of a standard solution of a ferric salt, the end-point being determined electrolytically. The same method may be used for thioindigo or methylene-blue. —B. C. I. R. A.

Fats and Oils: Rancidity. J. A. Emery and R. R. Henley. Jl. Ind. Eng. Chem., 1922, **14**, 937-940.

Experiments are recorded which indicate that air, oxygen alone or in combination, light, and contact with metals are among the factors which influence the development of rancidity in fats and oils. The Kreis test was applied throughout for the detection of rancidity. Corn oil and cottonseed oil do not become rancid as rapidly as animal fats, perhaps because they contain glycerides of the lesser saturated fatty acids. —B. C. I. R. A.

Wood Cellulose. S. A. Mahood and D. E. Cable. Jl. Ind. Eng. Chem., 1922, **14**, 727-731.

Data are presented which indicate that cellulose from wood and cellulose from cotton do not represent identical chemical aggregates; similarly, the wood celluloses obtained by acid cooking and by alkaline cooking are not identical. The wood cellulose most nearly corresponding to cotton, taking purified linters as a standard, is obtained by recooking "easy bleaching" sulphite pulp with soda and bleaching with 2% bleach. The cellulose differs in the amounts of furfuraldehyde-yielding constituents present and in γ-cellulose content. Recooked, raw cooked sulphite pulp bleached with 3% bleach does not differ markedly from the above sample and represents a 6% higher yield on the basis of the original wood. It is probable that the yield of cellulose suitable for the manufacture of esters could be materially increased by giving a light or raw cooked stock a bleaching treatment prior to cooking with soda. Pulps produced by alkali are chemically less similar to cotton than those produced by acid or acid and alkali cooking. The usual analytical data are recorded and the procedure is briefly described.

—B. C. I. R. A.

Soap Solutions; Ultra-Filtration of——. J. W. McBain and W. J. Jenkins. Trans. Chem. Soc., 1922, **121**, 2325-2344.

A theory of ultra-filtration through permeable and semi-permeable membranes is developed. Ultra-filtration of potassium laurate and sodium oleate has confirmed the values previously deduced for hydrolysis, osmotic pressure, and amounts of crystalloidal and colloidal matter. A general method of determining the solvation of the colloid by ultra-filtration is described, and it is shown that soap in solution contains at least 10 molecules of hydrate water per equivalent of soap. The ionic micelle has been separated from neutral colloid by ultra-filtration; the diameter of the particles of ionic micelle is only a few times the length of the molecule and its approximate formula is $(\mathrm{Ol}')_{10}$, $m\mathrm{H_2O}$. Whereas the particles of neutral colloid of potassium laurate are less than 15 *uu* in diameter, those of sodium oleate are about ten times larger.

—B. C. I. R. A.

Micro-Sublimation Apparatus. A. Schoeller. Z. angew. Chem., 1922, **35**, 506-507.

The apparatus is simple in character, and is intended for the sublimation of substances under reduced pressure when the sublimate is to be examined microscopically. Microscope slides are cut into strips about 9mm. wide, and the ends of these are bent at right angles on the same side. One of these strips is slipped into the sublimation tube, over the substance to be examined. The open end of the tube is attached to a pump and the tube is heated by means of a special copper block and micro-burner. The sublimate forms chiefly on the glass strip, which can be removed and examined directly under the microscope. —B. C. I. R. A.

Colloidal Solution: Action of Sunlight. P. B. Ganguly and N. H. Dhar. Kolloid Zeits., 1922, **31**, 16-19.

The action of sunlight on colloidal gold, silver, platinum, copper, sulphur, selenium, a number of colloidal sulphides, hydroxides and complex colloidal solutions, both pure and in the presence of protecting colloids, has been investigated. In most cases it is shown that sunlight increases the rate of coagulation. In the case of the metallic sulphides, the sensitiveness towards sunlight follows the order→arsenic, cadmium, mercury, and antimony sulphide, while in the presence of gelatin as protecting colloid the order is→nickel, platinum, zinc, gold, iron, cobalt, and silver sulphide. In the case of a manganese dioxide sol containing 0·3 grams of manganese dioxide per litre, sunlight has the same coagulating action as 2·5 c.c. of a 2*N*-solution of copper sulphate acting on 25 c.c. of the sol. Colloidal solutions of stannous, bismuth, lead, manganese, and ferrous sulphides, when acted on by sunlight in the presence of air, are oxidised with the formation of colloidal sulphur, which on further action of light is coagulated. —B. C. I. R. A.

Sol Standard and Turbidity Standard. H. Bechhold and F. Hebler. Kolloid-Zeits., 1922, **31**, 132-137.

The authors designate as standard turbidity the turbidity of a 0·001 molecular suspension of barium sulphate, prepared by mixing equal volumes of 0·002 molecular solutions of hydroxylamine sulphate and barium chloride in glycerol. It consists of primary particles with average diameter 2·5 *u*. They specify as standard sol, a 0·005 molecular suspension of barium sulphate prepared by mixing barium chloride and magnesium sulphate dissolved in glycerol containing 15% of isobutyl alcohol. This sol is about three times as turbid as the turbidity standard, and may be adjusted to the latter by dilution. The standard sol consists of particles of not more than 90 *uu* diameter. It is stable for at least six months, but its nephelometer effect remains unchanged for not longer than eight days.

—B. C. I. R. A.

Electrometric Titration Apparatus. W. E. Garner and C. A. Waters. Jl. Soc. Chem. Ind., 1922, **41**, 337-338T.

An illustrated description of a simple apparatus for electrometric titration. The electrode vessel carries a small bulb with two side tubes, turned downwards and constricted at the ends. These capillaries make it possible to start a titration with only 5 c.c. of solution in the beaker, whereas an apparatus of the type described by Treadwell requires nearly 50 c.c. before the ends of the capillaries are immersed.

—B. C. I. R. A.

Hydrogen Electrode Vessel. G. E. Cullen. Jl. Biol. Chem., 1922, **52**, 521-524.

Clark recommends that the hydrogen electrode vessel described by him should be set up in a constant temperature air bath, for he has observed that in running determinations at 38° 10 to 15 mins. elapse before solutions introduced at room temperature reach the temperature of the bath. When the cell is wet the time becomes longer. There is thus a definite possibility of error from trusting to judgment in estimating the time required to attain temperature equilibrium. Further, it is shown that if the Clark cell is used in the open room and the temperature read from a thermometer suspended either in the potassium chloride reservoir or in the air beside the cell this reading does not represent the actual temperature of the cell contents. The author describes a modification of the cell to permit accurate temperature control. An extra opening is provided in the cell and a short calibrated thermometer, carried in pure rubber, is introduced. An illustration describes the device clearly. —B. C. I. R. A.

Fatty Acid; Estimation of——. W. R. Bloor, K. F. Pelkan, and D. M. Allen. Jl. Biol. Chem., 1922, **52**, 191-205.

A nephelometric method is described for the estimation of small amounts of fatty acids in such materials as blood plasma, in which case only 5 c.c. of liquid is required. —B. C. I. R. A.

Shanghai Raw Silk Situation. G. A. Post. Amer. Silk Jl., 1922, **41**, 59.

The Testing House appears to be less successful than was hoped. The author urges all concerned to insist on having all silk sent there, as there is need for a standard of winding, evenness and cleanness. —F. G. P.

The Development and Future of the Production of Artificial Filaments for the Textile Industry. See This *Jl.* (Proc.), 1922, **13**, 167.

PATENTS.

Emulsion: Separation. Metcalfe-Shaw Corporation. E.P.179,194.

Emulsions are caused to separate into their constituents by being absorbed in, and subsequently expressed from, the pores of a material such as cotton waste, which exerts a capillary action thereon and which is preferably of a spongy nature. Three types of apparatus suitable for carrying out the process are described, one of which consists of an endless moving belt of cotton which dips into the emulsion at one point and is squeezed between two pulleys at another point. —B. C. I. R. A.

7.—BUILDING AND POWER.

(C)—POWER.

Textile Factories; The Driving and Maintenance of——. D. Brownlie. Text. Rec., 1922, **40**, No.475, 61-63.

A general consideration of possible economies and future developments in the driving and maintenance of textile factories. —B. C. I. R. A.

Electrical Driving of Textile Machinery and its Possible Future Developments. V. Mallalieu. Text. Rec., 1922, **40**, No.475, 83.

A general discussion on the subject. —B. C. I. R. A.

The Uses and Advantages of Electric Power in the Factory. See This *Jl.* (Proc.), 1922, **13**, 165.

(F)—LIGHTING.

Textile Mills; The Lighting of——. Text. Rec., 1922, **40**, No.475, 99.

The recommendations put forward in the second report of the Home Office Departmental Committee on industrial lighting are discussed. Suitable lighting requires absence of glare and shadows, steadiness and constancy of light source, and a reasonable degree of uniformity of illumination and surface brightness over the work. The arrangement and sizes of units suitable for various processes in cotton mills are discussed. —B. C. I. R. A.

9.—COMMERCE, ECONOMICS, LABOUR, ORGANISATION, COSTING, &c.

France: Activity of Cotton Spinning Industry. Bd. of Trade Jl., 1922, **109**, 499.

According to "Information Financière" there has recently been much activity in the cotton spinning industry in the Roubaix-Tourcoing district. A table is given showing details as to the activity during the months of June, July and August, when 7,046,000 kilogs. of cotton were spun and 7,307,000 kilogs. delivered. —L. M. S.

B.A.W.R.A. Wool: Stocks and Disposals. Bd. of Trade Jl., 1922, **109**, 469.

Stocks and disposals, Jan.-September, 1922. —L. M. S.

Japan: Silk. Bd. of Trade Jl., 1922, **109**, 338.

The enormous increase in Japan's export figures for 1921 is almost entirely due to silk: 40% of the total Japanese exports is represented by silk. —F. G. P.

Swiss Silk Bolting Gauze. Bull. des Soies, 1922, **46**, No.2367, 4.

The quantity exported in 1921 was equal to that of 1920, but lower than in former years. —F. G. P.

10.—MISCELLANEOUS.

Philippines; Book-binding Substitutes Needed in——. U.S. Commerce Rpts., 1922, Oct. 2, 11.

The damage done to book covers by the action of mould and by insects, and the injurious effects which preparations for protecting bindings have upon cloth and leather create an opportunity for introducing substitute materials for bookbinding in the islands. —L. M. S.

Zinc Oxide and Lithopone as a Basis for Paint in Bleacheries and Dyehouses. B. de Puyster. Col. Trade Jl., 1922, **11**, 223.

The gradual introduction of zinc oxide as a basis for paint in place of white lead has made much progress. The development of lithopone, a mixture of zinc sulphide and barium sulphate, has also extended very much the use of zinc paints. The comparative covering or "hiding" power of various paint bases is set out in tables. Photomicrographs of various pigments are reproduced in connection with the fineness of pigment. The oil absorption of the pigment is also important in considering paints for dyehouses and bleacheries and is considered in the tables. —L. M. S.

Temperature Regulator. Text. Rec., 1922, **40**, No.475, 235.

An illustrated description of a "Tag" temperature controller. There are several types of "Tag" instruments for indicating and recording temperatures and automatically controlling the temperature in piece-dye kettles, wool-scouring, bowls, slasher size boxes, ageing machines, can dryers, etc. —B. C. I. R. A.

Caustic Lye Heater. K. Schreber. Chem. Zentr. (from Die Wärme, 1922, **45**, 353-355), 1922, iv, 824.

A plant is described whereby the heat of dilution of caustic soda may be utilised as a source of energy in textile factories. —B. C. I. R. A.

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